

AVIATION WEEK

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June 24, 1957

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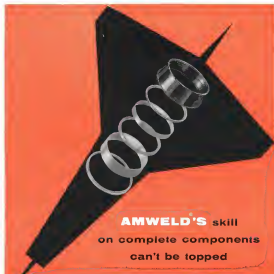
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AVIATION CALENDAR

(Continued from page 5)

- [illegible]



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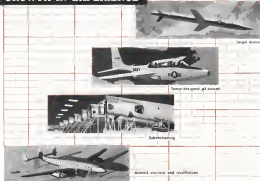
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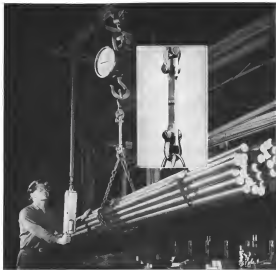
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EDITORIAL

Courage to Face the Future

Last week we shared a delightful evening with several honored members of the Institute of the Aeronautical Sciences in Los Angeles listening to the personal reminiscences of three titans of the aircraft industry—Donald Douglas, J. H. "Dutch" Kinnelberger and Robert Gross. They were speaking as representatives of an industry that now employs 285,000 people in the Los Angeles area alone and has a weekly payroll of \$25 million.

But their tales were of the lean and hungry days when the aircraft industry first took root in the then struggling Los Angeles climate. The courage, determination and ingenuity of these pioneers in creating a new industry based on a new and then hardly acceptable technology should be a great source of inspiration for the younger generations of engineers and managers who are now the sleek troops of the largest single manufacturing industry in this country.

Aviation Fever

There was Donald Douglas telling of how he was taken in body by the aviation bug that he left the Naval Academy at Annapolis to pursue the aircraft technology at the Massachusetts Institute of Technology as the classroom of Dr. Jerome C. Hunsiker. Spawning a graduate year operating the first seaplane wing tunnel in this country at MIT, he went on to become chief engineer for Glenn L. Martin and then struck out for himself in Santa Monica with capital of \$600 to found the giant aircraft enterprise that now has plants as well as El Segundo, Long Beach and Tulsa. In addition to its military contributions in aircraft and missiles, the Douglas name is the hallmark for superb transport aircraft.

There were frankly rude remarks about the first Douglas military product, the O-2 observation plane, by "Dutch" Kinnelberger, who was then chief engineer for Douglas, and Ira Eaker, who as an Air Corps lieutenant made the first delivery flight of this aircraft. It had an uncontrollable dance to spin without any ability to recover from the maneuver. Eaker recalled how the Air Corps solicited this problem simply by screwing a placard to the instrument panel stating, "This aircraft will not be spun." And "Dutch" Kinnelberger gave engineering five of placing a 400-lb. casting in the nose of the fuselage so that the pilot could jettison the casting with a hand switch when it had stability trouble.

When "Dutch" came first to join the Douglas Company he could pack all of the existing technical literature on the state of the art in two cardboard suitcases. He brought his family to California in a Model T Ford, camping out along the trail in a tent of his own design and construction. Ira Eaker, who was modelmaker for the panel, recalled that that was the only Kinnelberger design that never went into mass production.

Bob Gross told of how he traveled from the banking business into the Varney Air Transport Co. that flew the sleek design of the Lockheed brothers up and down the West Coast, making funds and losing money. Gross ducked at the impulse, then considered sheer insanity,

that prompted him to buy the assets of the bankrupt Lockheed company for \$30,000 in the Los Angeles County Courthouse. And he noted that, in so on when mass engineering effort in the future, it was an extremely small group of Lockheed engineers led by "Reddy" Johnson that created the first Lockheed jet fighters—the P-80—in just 150 days.

There were tales of the tribulations encountered by managers in the uncertain square eyes of aircraft financing and market policy that called for more than the average managerial ingenuity. Typical was "Dutch" Kinnelberger's recollection of VJ day when he found himself with 60,000 employees on his payroll and only 24 aircraft in build after cancellation of orders for \$300 million in 24 hours. Out of these tales the phoenix of the post war industry grew to new peaks of employment and profits and an increase of infinite magnitude in aviation, nuclear energy, missiles and hypersonic speeds entered its technical spectrum.

These pioneers who weathered so many technical, financial and political storms during the past quarter century knew they were speaking at the very time when their industry is facing another major political financial crisis. The details of this impending fiscal policy squeeze that threatens to cut the guts out of the nation's aerospace program have been reported in detail as *Aviation Week* in the preceding three issues. Some of the speakers and their listeners knew they would soon be on a Douglas or Lockheed transport winging out for a dramatic show-down meeting in the Pentagon with Defense Department officials on just what the aerospace future holds.

Crisis Is Real

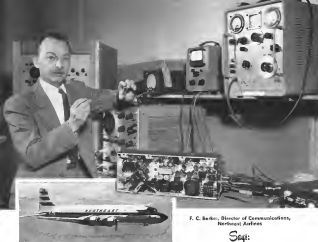
There is no question but what the impending crisis is genuine. At this writing it appears that the aircraft industry will have to take some bumps as a result of a governmental fiscal policy of defense value and wisdom. There is also no question that the aircraft industry will continue at a rapid pace of the aerospace economic and military strength despite any temporary problems posed by bumbling government fiscal policies.

Inevitably and properly there will be a seething out of the water incubation of this industrial complex and, with the technical sound and managerially efficient organizations will survive. As "Dutch" Kinnelberger told his audience:

"It is better to have a few mighty oaks than a forest of weak saplings."

In the time of crisis it was understanding and appreciation for the young generation of engineers and managers to see and hear these three successful veterans of the front and home crisis of the past 25 years, each of whom founded and led his own organization to steady growth and current prosperity. They offered a good exhibit of the qualities required for survival and growth in this technologically exciting industry. The new generation can profit well in consequently facing the future.

—Robert Hoot



F. C. Berlin, Director of Communications,
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"We Know Not Where"

Look for pressure to end the Pentagon's watchlike policy of trying to spare soldiers' souls from Patrick Air Force when they exploded in full view of hundreds of spectators.

Current guidance is a memorandum from Assistant Secretary for Public Affairs Affairs Center which says that Patrick's commander can require such, plausible fringes and that in the case of explosion, is authorized to disclose whether there were any spectators.

Patrick's source purports the border means this way.

"We shut a muzzle into the air. It fell to earth we know not where."

An F-4 Phantom II that exploded in mid-air should not be classified and worried about Area's aggressive anti-missile campaign for its Jupiter IRBM system but publicly Air Force has continued to urge Defense Secretary Charles Wilson to relax restrictions and allow it to brief the press thoroughly on USAF missile program.

USAF may urge that the press be allowed to visit Patrick and witness a firing.

These Government Information Subcommittee also will look into Pentagon's candidate policy on Patrick firings.

Censored

In another move, Information Subcommittee will probe Defense Department's censorship of speeches by top senior brass—some others for policy reasons than for security.

The Subcommittee, headed by Rep. John F. Moss (D-Calif.) will charge that an in-censor Defense command. Several speeches by Army Secretary Walter Brueckner and five by Army Chief of Staff Maxwell Taylor. Army was told to make certain changes or scrap the speeches entirely. Talk of the changes had nothing to do with security.

Thirteen speeches by Chief of Naval Operations—all of those for policy reasons, rather Defense Department or international policy.

Changes made last November by the Pentagon Committee on Classified Information that serves watchdog "look" information in the press also will be examined.

One Pentagon Committee example was a list of ICBM contractors that appeared in Wall Street Journal. Sub-committee will show that contractors actually had been named earlier in a speech cleared by Defense and dated for an Air Force general at an Air Force Association conference.

Nuclear Aircraft 'Down'

The Administration's top-and-down program for development of a nuclear-powered aircraft is again in a "down" period. The Research and Development Subcommittee of the Joint Congressional Atomic Energy Committee is holding hearings to find out why.

In March Rep. Carl Albert (D-N.C.) chairman of the committee and Rep. Mel Price (D-Id.) sponsored the Defense Department for "advocative confusion and confusion" on the project (AW Nov 11 p. 14) in April Defense and Price released a report by Deputy Secretary of Defense Donald Quarles, then USAF Secretary that the project had been put "in a definite limbo."

and given a high priority (AW Apr. 22 p. 28).

Last week, however, Price told American Times that "we are not going to an even period of delay. The project has not been given sufficient priority—and of course money is involved."

Airways Bill Outlook

That Senate action on the Airways Modernization Act of 1957 is expected with a better than 50-50 chance that the bill will pass the upper house without undergoing any major modifications. Senate Commerce Committee unanimously approved the bill with several amendments which members of the Senate Finance Planning Group say were to "strengthen" the act. Principal amendment calls for establishment of a permanent Federal Aviation Agency to be presented to Congress by January 15, 1959. Edward Clark, steering head of the Planning Group (AW June 17, p. 71), had set a 1960 target date for the organization of the permanent agency.

The committee also added a new section to the bill regarding coordination between the Aeronautics Administration Board and both the Civil Aeronautics Board and Federal Communications Commission before any system is adopted. Possible House action is also expected despite some opposition toward the bill by several House Commerce Committee members.

Gentle Cut For NACA

Congress is cutting the National Advisory Committee for Aeronautics Fiscal 1958 budget with a gentle hand. House has approved \$101 million; the Senate \$106 million. NACA requested \$118 million (AW Jan. 21 p. 28). However, the program will be substantially higher than the \$77 million budgeted for Fiscal 1957. The \$1 million difference between House and Senate amounts is up for discussion in a conference group composed of members of both houses. Also up for discussion is the conference. Whether NACA can contract with universities and other contractors for research. The House banned this authority. The Senate agreed to continue it.

Security Review Revision

Watch for amendments to indicate that Air Force has revised its security review procedures in an attempt to have a stronger voice in what contractors information may be released to public.

Last week, Army and Navy have reviewed manifestly better proposed review releases for both security and access policy before submitting them to Defense Department's Office of Security Review.

Air Force, however, has not said as proposed who have assigned to Defense Department's Office of Security Review. Although they are Air Force Officers, they would, under, were paid by and were asked for officers to be the chair of the Office of Security Review.

This led to changes by Air Force contractors and USAF staff that Defense was too strict on release of information. Congress, Defense often charged that USAF (GEO) is too strict on security access in USAF's interest than in Defense Department's.

Within 60 days, Air Force will establish a separate security review office under its chief of public information, following the Army-Navy pattern.

—Washington Staff

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plenty of the problem and the number of system alternatives so that high-level representatives of industry, academia, and government can sit around a conference table and agree at least on planning dimensions, and perhaps on a goal.

Unless such a course of action is taken, nations will continue to be produced which the nation has rendered obsolete before they can become nationally useful. Frey declared. Nearly every transportation has a small operation which seems engaged in some sort of stock work, but these studies must have factors brought into them to reflect the problems of all three parts: new, existing, and obsolete and reactions.

Interdependence of these three agencies has not been clearly recognized, Pacy declared. Stades have indicated that some Soviet weapon systems have been developed in approximately half the time that it takes this country, and that our long delays are primarily due to our present decision process. It has only recently been recognized that the reason for a slow decision process is that all three groups are involved and that the process of intercommunication is enormously slow.

In an open discussion after delivery of the paper, Finn declared he was not as much concerned with the relationship between industry and military as he was with that between industry, military and the government, adding that there wasn't an adequate mechanism to deal with the problem.

Long-range weather systems planning is based on state of the art, state of the mind and state of the pocketbook," commented Lt Col C R. Tice, assistant executive officer to the commander, Air Research and Development Command, USAF. He cited the B-55 as an example where state of the mind played a big part. There was no sense

Jet Flap Effectiveness Doubted

Los Angeles—Bumadun Inc. could not get flags here, so it had to offer the national designer who would select designs for its new American collection, an audience at the summer screen of the Institute of Contemporary Sciences here was told by William T. Blumstein, staff captain of Burning America Co.

Hofman's example was a tricalc that required jet transport in the Boeing 700 class. He concluded that the "extra high lift device" might pay off in shorter field lengths for applications where larger than 8000-ton aircraft are desirable, but denied their usefulness in subsonic, long-range jet transport. His consideration was directed mainly at tricalc ground roll and post-takeoff climb as representative critical performance areas.

of urgency, "no kicking to push, push, push," he said. "You find that the state of the art overrules you. E-85 is a fine place but probably overtaken."

In the opposite view, referring to the Tice intermediate-range ballistic missile development under program, he stated that in one year it was sitting on the pad as an operational configuration.

Time doesn't must always be kept in view, declared Capt. D. J. Wells, a naval chief, plans and programs, Navy Bureau of Assessment, but "there are a lot of matters to deal with before sailors can make a major decision." Even the consolidation of a program is a non-consumer job, he added.

Executive: President:

Budgetary problems are tremendous, he said, and a major mistake in a program today might mean that it may never get back on its feet again.

Emphasizing another aspect of technical requirements planning, Carlo Wood, chief engineer, Douglas Aircraft Long Beach Division, declared that industries must work with the user community early, that it is too late when system requirements are already generated.

Importance of establishing equipment requirements early with the sponsor has been stressed by Frick, who said that often the weapon system includes equipment which the sponsor does not use. "We want eliminate a lot of trials in that direction, and, yes, when we can't afford those, all."

Equipment reliability aspect was mentioned by Capt. Wildt, a he said "we must try to avoid what has happened in the past—delivery of a plane to the fleet with its fire control not working, he said.

jet flap might otherwise show. It does, however, offer an advantage in weight lifting capability for shorter takeoff runs if no allowance is made for trimming out moment produced by full

The comparison does not show what the alternative would amount to in terms of performance loss. Other pit flap findings pointed out by Hunsdon were weight increases caused by dust weight and structural beef up of highly stressed wing members to cope with heat seal splice problems caused by displacement of fuel from the wing.

Flap effectiveness before separation is not significantly impacted by slots or BLC under these or other means of preventing separation. Hamilton and the best mechanical and BLC flaps have nearly identical lift and drag characteristics up to deflections of 30 or 55 degrees. At greater deflections the mechanical flaps stall while flaps using boundary layer control continue to add lift and drag.

As with the jet flap, HLC shows no weight lifting advantage for an 8,000 lb ground roll as it does for a 4,000 lb roll. If it were convenient to use larger engines, HLC would have shown a larger advantage, he said.

Management: A good example is

Prospects for application of research results to synaptic neurodegeneration were discussed by W. R. Sears and E. L. Heber, Jr., of the Cornell University Graduate School of Neurobiology and Behavior. They reported that neurodegeneration may be induced in a number of

The book also covers a considerable

fluid is heated by the interaction of magnetic lines of force about a current flow in the fluid and those in a nearby magnetic field. Since it is proportional to the square of magnetic field strength and the electric current, the temperature of the fluid, conductivity of the flow and electromagnetic force must be high if electromagnetic body force is to be comparable to buoyancy in a system where pressure is the flow field. It is thus possible to consider the flow of a good conductor to be the flow of a poor conductor with a large multiplier to get a high enough ratio of body electrons to the original number of particles to produce good conductivity. A possibility to be considered is that the electromagnetic force will cause the particles to be forced or might cause them to be forced to move in a direction so as to produce the appropriate current.

The authors reported that a magnetic ring has been discussed at CERN.

a decrease of light intensity.

were studied by Various Aspects of Sensory-motor, low life and that while their instrument sensors have imposed dynamic stresses have demonstrated because itself response is being sacrificed by high performance thereby demanding faster instrument response. It pointed out that since instruments had to computer and control surface stress are taking responsibility for intrinsic stability, remote phase lag in the instruments have become totally transcended.

An example of an anastomosing dendritic network cited by the authors is the typical airplane static pressure system which consists of pneumatic columns connected by orifices and tubes. Measurement of a varying environment by such a system is seldom valid because the value of pressure drop through the pneumatic lines varies with the varying conditions, and is not therewith proportional.

He said that these constants of static systems is much longer than, conversely, behaved and stay approximately in touch with pressure. A typical system using standard instrument tubing with an inside diameter of $\frac{1}{8}$ in. and typical lengths and volumes will have a natural time constant of half a second at 50,000 ft. This will lengthen to 15 seconds. The danger of such a lag is obvious when compared with the rapid rates of climb and descent possible in high performance airplanes.

G Forces Challenge Engineers

Los Angeles—Included among prospects for high performance various airplanes are longitudinal modifications and combinations of 4 to 5 Gs, Walter C. Williams and Herbert M. Drake of the NACA high-speed flight station at Edwards AFB told the National Seminar Meeting of the IAS.

While such accusations have been expressed in earlier works, they, said, the dentures have not been of comparable length. Much research will be needed to solve critical configurations and pilot penetration problems for the future dentures.

Though such work as the N-11 will not be designed primarily for ballistic flight at extremely low dynamic pressures, they are the logical vehicles to prove much of the information needed in these regimes. First study of use of reaction controls at low dynamic pressures will be made with the N-1B.

Rail coupling must be studied. Critical frequency for coupling will be low, producing problems of rail wear as low as 20 to 30 degrees per second.

Asks to intensify investigation were discussed by Frederick Stevens and Frank W. Lynch of Northing. They said that automatic star tracking and instrument check-point tracking offer a solu-

Selctum is larger diameter pressure tubing. When tube column is used compared to bed volume, the fourth point of diameter enters the equation and measuring it from Δu to Δu will cut the 84,000- Δu time constant from 15 seconds to less than one second. The selctum gauges the reaction effects of flow over static head effects and the validity of any curve is questionable.

Presented in this volume are six papers on producing endurable single pulse systems at all about three cycles per second at normal ambient temperatures and yet at 100 cycles per second in aerodynamic heating. Because no one has been found to stop the aging process, the authors have taken the time constant of the system as the time constant of the abscissa itself must finally be at least a half second. Application of some balance of force intrinsic principles enables the designer to eliminate lag errors for a constant velocity vehicle. Though such steady state errors can be compensated, transient errors cannot and these errors in entry, recovery and frequency drive the response.

The skill and knowledge of the instrument maker has little effect on disease incidence because the standard and specifications rest on responsibility at the edge of the problem. Only the user with extreme responsibility has the opportunity to correct them.

in a manager, according to George Trumbull, vice president engineering, The Martin Co. This training teaches him to define clearly what the problem is, how to logically move it to a solution, the practice of intellectual honesty in solving problems.

On the other hand, Frimble and Davis' fragment is not a right answer yet as to a management question, and here basic science is necessary to achieve the best possible answer.

Regarding a choice between pursuing technical specialization and management, Lou Gerstl, vice president and general manager of the Santa Monica Division, Douglas Aircraft Co., writes that the choice is not for the people to multiply. "The effects while in technical specialization he creates using his own efforts alone. His natural inclination should be a guide in the choice," Gerstl says, since people formerly in technical specialties now are available to the technical specialist on a par with the manager.

A requirement for the engineer to learn to improve his management skills, according to D. D. Gaudin, director of engineering at the General Motors, is to become more familiar with the customer's real use of the product to be designed and produced, to learn to take a company's objectives as the customer's requirements for the product.

Small Jet Liners

Los Angeles—First details of a small jet transport being developed by Lockheed and North American Aviation to meet USAF's new medium transport requirements were revealed at business aircraft sessions at IAS National Summer Meeting.

• Lockheed GL-329 will be a 13-passenger swept low-wing layout with four jets mounted on the rear fuselage in side-by-side pods. Gross weight will be 78,000 lb., cruise speed 500-510 mph at 25,000-45,000 ft.

■ North American Saboteurs will not lose to any propeller, here it. GLE 105 turboprop in the wing roots. Cruise speed will be Mach .76 at 39,000 ft.; top speed will be 540 mph. Maximum take-off ground roll will be 2,180 ft., single-engine takeoff will be clear a 30 ft. obstacle will take 1,200 ft. Single-engine climb will be 35,000 ft.

Efficiency of Greek Air Force Adds Strength to NATO Flank

By Claude White

Athens, Greece—Royal Hellenic Air Force is not large, but its top officers believe it is a vital against NATO's flank against Soviet aggression in the Eastern Mediterranean.

Considering the capabilities of RHAF equipment, there is little doubt the Greek outfit may be the most efficient unit of allied support. Combat and non-combat RHAF get fighter-bombers and interceptors from the neighborhood of 90% of the NATO powers, and 38% of the NATO arsenal.

Today Greece is paying \$20 million a year into support of the RHAF. This is 24% of the entire defense budget. Another \$6.5 goes to the Navy and 25% to the Air Force. Total for the three services takes 96% of the national budget.

On top of this, RHAF receives a substantial amount of aid from the United States Aid Program and in a chapter for consideration under the

Emergency Doctrine. There is no exact figure available on how much is contributed from outside Greece, because the aid comes in the form of equipment and such services as the training of RHAF pilots and technicians at USAF schools in Germany, Africa and the United States.

At Eleftheria base, a few miles outside Athens, there is evidence of a strong effort to improve combat efficiency further by raising the level of pilot proficiency. House of the 117th Combat Wing, Eleftheria is a small base, but U. S. standards, but complete with all of the controls for practice missions from the state of Greece, single lines to the P-51s grip on the walls of the pilot's cockpit.

Reg. Gen. Constantine Goussopoulos, RHAF deputy chief of staff for plans and operations, told Aviation Week he is less interested in new equipment and more equipment than he is in developing a perfect system with what he has. This refreshing ap-

proach stands in contrast to that of some other allied powers who are pouring for assets in the Eastern skies before getting maximum capability out of what they have.

RHAF pilot proficiency is in no way as good as the combat readiness record of its training planes—Republic F-84Fs, F-84Gs and North American F-86Es. However, the 31st Air Training Command is well as the three Combat Wings of the RHAF are working hard to make the pilots in good as the aircraft.

Gen. Goussopoulos turns the task of defending Greece to the RHAF's prime mission, but emphasizes there is more than a selfish reason for this. He says the Western Powers have a vested interest in his success because Greece is a strategic point to all branches of the allied armed forces.

Occupation of Greece by the Russians, he points out, would have these devastating effects:

- Ground forces would be annihilated in Turkey and Italy.
- Naval bases would lose control of the east and central Mediterranean.
- Air Forces would lose bases of concentration in the Mediterranean and bases in North Africa and the Middle

East would be neutralized in essence.

• Middle East oil would be a nuclear resource constantly menaced by Soviet tactical air forces.

RHAF planning, and NATO planning, is based on the assumption that a future general war will be nuclear and that the initial phase will be decisive. If Greece escapes occupation, it will provide about a dozen bases from which to conduct air-ground operations and create invasion, Greek air of these fields are completed, but the rest will be available soon. The program started in 1953. The bases will be limited by 110 mi. field position.

Equally important, the NATO defense mechanism are a chain of radar control and early warning system now under construction. Long have not been revealed, but some of them are high in the mountains. To reach them, the RHAF later this year will be equipped with one squad unit of Sikorski H-19 helicopters.

Top making officers of the RHAF view the U. S. 4th Fleet in the Mediterranean as a strong segment of allied support, but that have reservations about how much help it will be in the initial phase of a nuclear war. If the fleet attempts tactical missions in the

Greek Air Strength

The Royal Hellenic Air Force is composed of three commands:

- 26th Tactical Air Command
- 11st Air Training Command
- 10th Materiel Command

In the event of war the 10th TAC would be assigned to the 4th Allied Tactical Air Force.

There are about 47,000 men in the RHAF, more than 180 of them pilots. Each combat aircraft takes in flying about 20 to a month. The average size is 24.5 per 100,000 living people.

The training Command has an Academy with a three year course and a Reserve Training Center where the course runs from 18 to 20 months. In addition, there is an Air Crew Center and an RHAF Engineering School with a five-year course in two maintenance offices.

Each part of a general war that has it will be lost. At best it will need defense forces land-based such as it is in this part of the Mediterranean sea.

Later, then, the 4th Fleet could stem away the source of conflict and contribute heavily to ground support.

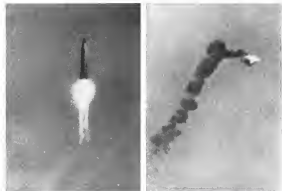
RHAF's contemporary history goes back only to 1918. From 1947 to 1949 it took part in the country's civil war against guerrilla Reds and was left completely out of business. The build-up started in 1952, after Greece joined NATO.

Cooperation with NATO and further continued support of defense in Athens, 1949 is a local political issue, but U. S. Ambassador George Allen is convinced it is not a serious one. The King of Greece holds a powerful hand in the national legislature and the support party is strongly pro-NATO. In addition, Greece with its long history of wars and the experience of being a nation is not considered likely to rise above any military reduction.

At the same time, the political opposition was controlled in a tool by the dictator. Hellenic war is the fate of the island of Cyprus, off the coast of Syria and Turkey.

The opposition charges that Britain and France use the island as a base for imperialist activity and that the Greek government is guilty of complicity in this activity.

The island is populated by a mixture of Greeks and Turks. Canada are holding two NATO bases on it.



Atlas Traces Its Fall in Trail of Black Smoke



Missilebursting of rocket motor producing control panel. Greece's Air Force intercepted ballistic missile in 1957 to begin to develop after launching at 10,000 ft. (AW last E, p. 27) Range safety officer touched detonator button to destroy the missile. Photos show it falling into Aegean Sea. Atlas motor is composed of two 130,000 lb thrust boosters and one 60,000 lb sustainer.



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TALOS MISSILE, in launcher at Naval Ordnance Missile Test Facility, White Sands Proving Ground, N. Mex., will join the fleet next year. Surface-borne rocket-powered weapons will form major armament of light cruise submarines, now undergoing conversion.

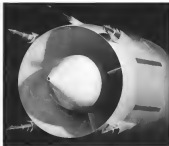


TALOS is capable of delivering intercontinental or nuclear warhead at range of about 40 mi. It is a homing-guided missile like the short-range Terrier, during initial phase of attack, guided by positive ground radio. Talos differs from Terrier in that it switches to a nonactive homing system for final phase of attack as an RFP down angle, possibly using ground radio signals reflected off the target. Talos is equipped with powerful radar warhead.

Talos was developed by guided missile laboratory of Johns Hopkins University, is being produced by Bendis Aviation Corp. at the Naval Ordnance Plant, Marietta, Ind. McDonnell Aircraft manufactures the airframe and engine power plant for the Talos. Radio Corp. of America produces the ground guidance radio. Solid propellant rocket is used during Talos launching (takeoff), dropping away after a few seconds when vehicle has reached speed where rocket engines can take over. Navy says Talos can be used against enemy ships and land bases in addition to its interception role. Two other variants will be equipped with Talos and it will be used on Navy's first nuclear-powered cruiser, Long Beach.



Navy's Talos Moves Into Operational Stage



GUIDANCE sensors include eight flat-mounted cups around nose section (above and left), and four probe-type antennas in nose. Steel spikes were installed in this place in model at NRL conversion in Washington. Fifth nose probe appears to be angle of attack and angle of yaw sensor. Forward control surfaces of Talos are invisible and provide directional control. All are there are kind.



Capital Sees \$2.5 Million Loss for '57

Earlier estimates of \$2.1 million profit cut by \$4.7 million on deferment of Viscount purchases.

By L. E. Doty

Washington—Capital Airlines' President J. H. Carmichael reported last week that his company has been forced to scrap its 1957 estimate of a profit of \$4.7 million because of earlier production of a \$2.5 million net profit to an estimated \$2.5 million loss.

The reason, Carmichael said, is Capital's new prospects of finding available funds to purchase more Viscount turboprop transports. The airline already has been forced to delay the planned purchase of 15 Vincents to add to its present fleet of 59 IAW Mac 15's.

Violating before the Civil Aeronautics Board's Suspenders Passenger Pay Case, Carmichael warned that the airline will be unable to expand any of its existing program since Viscount he added, however.

"I don't know where we are going to get them (Viscounts)" although "I am not optimistic."

No Market for D40s

He also disclosed that the company has been unable to dispose of its fleet of 52 Lockheed 049 Constellations and now "sits" has been absolutely no market for the aircraft.

Carmichael explained there had been no purchases of a 54-2 Lockheed along price, adding that the last figure disclosed with a potential purchase was \$900,000 per airplane.

Carmichael admitted that Capital is "very badly cashed" in need of net proceeds from such a sale but emphasized that disposal of the Constellations would cause a serious shortage of equipment for the company.

"We must replace the Constellations to stay steady in our own," he said, but "we can't operate the Capital system with only 59 Vincents and DC-3s and DC-6s."

The airline's original financial forecast, prepared in late 1956, was based on the sale of this equipment in a banking group headed by the Chase Manhattan Bank, of New York, in support of a request for a \$45 million loan to finance the 15 Vincents and 14 Const prop transports. Carmichael said he had "no plans of going forward with the financing program."

S. B. Caldwell, Capital's manager in charge of finance and operations, said the forecast was based upon "purchase orders" in the Constellations and the addition of new Viscount equipment. He said modifications of this forecast will now accurately bear out because of these acquisitions were now "solid."

Principal changes incorporated in the new forecast:

- Net profit of \$2,892,000 originally forecast has been replaced by a net loss of \$1,575,000, a drop of \$4,467,000.

- Operating profit of \$8,700,000 was reduced by \$7,575,000 to an operating profit of \$1,125,000.

- Total revenue of \$95,078,000 is now forecast, a \$15,175,000 decrease from the original estimate. Revenues in 1958 totaled \$83,706,341.

- Operating expenses in 1958 forecast at \$84,346,000, \$5,191,000 less than the original forecast. However, Caldwell pointed out that \$3,617,000 of the decline in expense came from lower depreciation and is not a cash expense saving.

- Revenue plane-loads for 1957 were reduced in the forecast by 4,111,800 to 57,924,000; revenue passenger-miles were cut by 205 million to 1,531 million. Load factor estimate for the system was raised from 55.14% to 60.59%.

Estimated load factor for the Viscount is 62.4% as compared with 59.4% for the Constellation, 51.9% for the DC-6 and 50.5% for the DC-3.

Deficit Widened

Goldkugel warned that the cash balance at the close of 1957 is projected at \$1,515,000, "considerably lower than necessary to properly service cash demands and maintain balances in deposits." He added that payments on equipment rental amounting to \$10.7 million will exceed anticipated revenue from depreciation and amortization of \$9.5 million by \$1,515,000 in 1957.

Carmichael said the Viscount operated at a break-even load factor of 54.7% or 2.19 passengers per airplane, during 1956. He said he anticipates no change in 1957. However, he forecast a break-even load factor climb in Lockheed 049 Constellations from 61.6% in 1956 to 67.5% this year.

Because of increased utilization of

the DC-3 fleet, Carmichael forecast a decline in the DC-3 break-even load factor from 62.3% last year to 61.6% this year. DC-4 break-even load factor is estimated at 56.3% for 1957 as compared with 55.8% last year.

Carmichael said that, after full cost allocation, the DC-3 lost \$5,052,000 in 1956 the DC-4, \$1,846,800, and the Constellation, \$48,514,800. The Viscount fleet showed a profit of \$3,774,000 to balance the year's operating loss to \$2,801,000.

Short Haul Closes

In a strong defense of the Viscount, Carmichael said, "We'd be in sorry shape without it." He admitted, however, that the Viscount load factor has been "lower than anticipated."

Carmichael stressed some of Capital's weaknesses in its route structure, explaining that the "short-haul" is the core of Capital. He said Capital's average load in 1956 was only 54% miles and added:

"I think we have reached the end of our rope without some change in our route structure."

He said the airline has discontinued plans to introduce 100 airplane daily round trips between New York and Chicago because of the deferment of the order for 15 additional Vincents. Capital now operates nine nonstop daily over the route which Carmichael termed "the most important" because a 40% break-even load factor for Vincents between the two cities.

Detroit-New York is another round-trip route Carmichael had hoped to expand further with a regular frequency of Viscount flights. He also expressed strong interest in the potential of such routes in Capital's markets in New York-Atlanta, New York-Birmingham, New York-New Orleans, New York-Memphis and Washington-Buffalo.

On a similar equipment will increase help generate these markets, Carmichael declared. Transport for 1957 were based on the additional equipment, he stated, adding that when he signed the contract with Western Airlines for the rental order of 80 Vincents, he told the manufacturers that "we are a 100 airplane company eventually."

Carmichael and Capital staff has a commitment with a "selling agent" through Feb. 31 giving him exclusive rights to sell all of the 17 Constellations. He said this commitment has not been met yet, although despite successful attempts to dispose of the aircraft.



PROPOSED terminal for LaGuardia Airport features two-level passenger building, 36 aircraft gates.

User Airlines to Pay Higher Fees As Share in LaGuardia Revamping

New York—Six airlines using LaGuardia Airport and the Port of New York Authority have come to terms on a \$12 million rehabilitation program for the terminal, second busiest in the world, included are:

- Continuation of a \$15.1 million per airport terminal three times the size of the present facility.

- Expenditure of \$4.5 million to beef up stairs, build a new control tower and improve and expand the terminal facility.

- Revision of roadway system and rehabilitation of streets at a cost of \$3.3 million.

- Construction of new parking facilities at a cost of \$57 million.

Major Phases

Major phases of the program are scheduled for 1958 completion, with work to begin this year. Airlines planning to operate from the revamped short and medium haul airport will pay an additional \$2.5 million annually in landing fees and rentals to handle the program costs. Airlines are American, Capital, Eastern, Northeast, TWA and United.

Arthur J. Tobin, Port Authority executive director, did not rule out the possibility that jets would operate from the rehabilitated airport, providing these new levels were acceptable. But

maximum weight of aircraft using the rehabilitated runway will be restricted to 175,000 lb. Tobin said and TWA's Corbett 880, smallest of the American jets, will gross 175,000 lb. maximum. National himself weight for the airplane is 193,000-115,000 lb.

Capital's runway at LaGuardia is 6,000 ft., although Tobin said the possibility of extending eastward Runway 4-22 is being studied.

The new terminal building will be a curved two-story structure 1,300 ft. long with four towers, larger serving a total of 16 gate positions. An elevated roadway will bring departing passengers to second-story jet entrance and the passengers will use the upper decks of the bridges to proceed to their planes. They will have to descend to ramp level to board, but Tobin said the layout will be adaptable.

Mexico Awards Routes

Mexico City—Awarards of Mexico has been awarded the new Mexico City to New York route and Company Mexicana de Aviacion the weekly Chicago route in decisions that have been announced by the Mexican government.

The Airlines award was granted to American West (see p. 40).

in use of finger-to-glass grippers at various other possible innovations. Arriving passengers will see ground floors of the fingers and bend their ground transportation at the lower level roadway.

The plan discards the tunneling at LaGuardia through a central terminal area with subsequent long walks to their individual aircraft, as is now the case at LaGuardia. Passengers will sit at one end, and depart from the street side of their individual airlines. The involved arrangement is designed to end the football game between incoming and outgoing passengers.

Unmanned host areas or lounges at the airport will be added and surfaced to provide an enlarged parking area for vehicles.

Terminal Construction

Terminal construction will begin with new wing buildings on either side of the existing terminal.

The final stage will be a new central building.

Airline executives were quite lively at the press conference announcing the plan—C. R. Smith of American, Thomas J. Armstrong of Eastern, R. J. Wilson of Capital, George E. Corbett of Northeast, and Corbett Jr. of TWA—unanimously played the five increase in needed by pay higher costs, such as the higher bills at LaGuardia.

Last year, airlines at the field paid \$173,000 in landing fees, \$170,000 in airport rental and \$300,000 for enroute service.

Tighter Traffic Control Rules Proposed for Adoption by CAB

Washington—New air traffic rules designed to tighten traffic control of all aircraft and increase minimum weather conditions for VFR flights have been proposed by the Civil Aeronautics Board for adoption early this fall.

The proposed regulations, which will affect eight major fractions of the air traffic control system, stem from recommendations advanced by the CAB's advisory committee on weather conditions for military and commercial aviation groups in the latter drive for more positive control of all traffic.

However, a recent air traffic rules amendment held by the CAB's Bureau of Safety for a review of the proposals disclosed that sharp differences of opinion still exist as to the degree increased control should be imposed.

Strongest protests against proposed VFR and instrument minimums were registered by the Aircraft Owners and Pilot Assn.

Recommendations

Main changes in Civil Air Regulations discussed at the conference:

- **Minimum weather conditions for VFR flights.** Civil Aeronautics Admin. Aviation, Army, Navy, Air Force, Air Transport Assn., Air Traffic Controller Assn. and Air Line Pilots Assn. advocate an increase in present minimum VFR criteria which prohibits VFR flights when visibility is less than statute miles. CAB, ATA and ALPA favor more liberal limits in controlled airspace deemed between three to five miles. The latter group argues that, in controlled airspace above 10,000 ft., visibility should be raised to five miles.
- **Definition of control area.** CAA wants limits of control areas varied where possible, and the CAB proposal would require control areas to be placed in the Civil Aeronautics Administration by designated flows at altitudes best suited to a local situation. Present limit is 700 ft. above the surface.

• **Airfield lights.** Proposed rule change would require all airports to display steady position lights at all times on the ground and as the air between sunset and sunrise. In addition, airports equipped with individual beacon lights will be required to display these lights in conjunction with steady position lights. Present rules do not say when they should be displayed.

• **Expansion of high altitude controlled airspace.** Proposed rule change in a Civil Air Regulation CAA wants to control all airspace within the outer control limits of the U.S. above 24,000 ft. and to reduce that floor to 15,000 ft. near coast. Minimum visibility for VFR

flights in this area would be five miles, minimum clearance from clouds would be set at 1,000 ft. vertically and one mile horizontally.

• **Operations within airport boundaries.** CAB wants to strengthen limits governing the control of traffic to and from airports and establish more uniform flight patterns within an airport area. AOPA calls for 140 mph speed limit in controlled areas around airport and recommended that military aircraft be unable to continue with such speed limits as authorized to maintain safety outside the airport. AOPA also wants use of climb and descent limit to a maximum of 1,000 ft. per minute below 5,000 ft. in all control areas.

• **Crashing altitudes.** Present rules call for two different requirements governing the selection of crashing altitudes: a quantitative regulation for flights over controlled airspace and add-on or default altitudes for flights over uncontrolled airspace. Proposed regulation would set a uniform crashing altitude to apply to all airports through vertical separation of IFR and VFR traffic.

• **Instrument takeoff and landing minimums.** To eliminate current minimums—regardless of the present regulations on instrument approach procedures, CAB proposes that raised rule specify that instrument approaches are required when visibility is less than three miles or when the ceiling is lower than the minimum aerial approach altitude.

• **Altitude setting.** To maximize "standard cross" as a clearance setting, Department of Defense has recommended the use of 29,927 ft. as a standard pressure setting of altitudes at high altitudes. CAB proposes adoption of this standard for all flights above 29,000 ft. For flights below 29,000 ft., it proposes altitudes be set by the current uncorrected pressure setting of altitudes as further than 100 statute miles from the airport. Introducing altitudes as a climb or descent zone to change from an altitude setting procedure to another.

The proposed regulations are likely to undergo some modifications during the rule-making process before they are published within the next 30 days. However, such changes are expected to be slight, although opponents of any phase of the revisions will have an opportunity to submit further comments on the regulations during the 60-day following publication of the rules.

One argument on the regulations will be held prior to their adoption. Recommendations accepted by the CAB for minimum weather conditions

for VFR flights called for a 1,500 ft. ceiling and five mile visibility for flights operating in a controlled zone without an ATC clearance. For flights operating in a control zone with an ATC clearance, the CAA has urged a ceiling at 500 ft. as the visible minimum for all VFR flights in all airports.

Air Transport Assn. called for a 2,000 ft. minimum clearance above clouds for VFR flights, while an airline group made very specific recommendations for increasing the presently prescribed minimum of 1,000 ft.

ATA also wants an increase in maximum below clouds from the present 500 ft. to a 1,000 ft. clearance for flights operating above 1,000 ft. and a 500 ft. clearance below clouds for flights operating under 1,000 ft. Many groups advocated a 1,000 ft. clearance below clouds. Army, Navy and Air Force called for a 500-foot clearance from clouds of one mile or flights operating above 10,000 ft. Air Traffic Controller Assn. recommended one half mile horizontal distance from clouds at all altitudes.

Two new items were proposed by the ATA-funded cloud proximity and lateral clear procedures. The group suggested that lateral cloud proximity, which is defined as the minimum distance from clouds at a 90 degree glideslope centered on the nose of the airplane, be set at five miles. Lateral cloud proximity, as the minimum distance from clouds at a 90 degree quadrant on either side of the aircraft, was proposed as a two and one-half mile minimum.

Semi-Circular Routes

Proposed "semi-circular" routes for determining appropriate cruising altitudes would require that all VFR traffic in and outside of controlled airspace cruise at odd thousands plus 500 ft. when an magnetic course of zero degrees to 179 degrees includes and at even thousands plus 500 ft. on courses of 180 degrees to 359 degrees.

VFR flights would be conducted at odd thousands altitudes between one degree and 179 degrees and at even thousands at other courses.

In proposing the change, the CAB's Bureau of Safety and the new system would simplify the selection of cruising altitudes and "resolve the difficulties at determining suitable altitudes along new, existing routes and in large control areas that have previously been somewhat disorganized."

Regulations covering instrument takeoffs and landings, if adopted, would require an instrument approach when no instrument approach is less than the maximum initial approach altitude or the visibility is less than three miles. The rule would prevent use of takeoffs when the ceiling is less than 500 ft. or the visibility less than one mile at airports which do not have minimum standards.

Tentative Australia Bilateral Pact Strongly Opposed by U. S. Lines

Washington—U. S. airlines are privately expressing strong opposition to the tentative air agreement reached between the U. S. and Australia.

The bilateral will give Qantas, the Australian national airline, rights to fly across the U. S. from San Francisco to New York and beyond to London, thereby establishing a round-the-world route.

In exchange, the State Department has asked for route from the U. S. to Australia via South America and the South Pole, a route from Sydney in New South Wales to Perth in the west part of Australia and beyond to South Africa, and a route from Sydney to Jakarta, Indonesia, to Bangkok.

Ticket Protest

Street G. Tipton, president of the Trans-Atlantic Airlines, which is leading the fight, declared that the Australian offer has absolutely no business being as a transatlantic U. S. airline or becoming a New York-London airline. In fact, the issue of the agreement is already offered by the State Department against continued State Department reluctance to follow established practice U. S. airlines, which has been the basis for the development of U. S. air agreements in commercial aviation.

The alleged agreement would weaken U. S. air strength not only in the Pacific but across the Atlantic and across our own country as well. The alleged agreement—which is neither

example of giving something for nothing—makes concessions which are completely unnecessary and unwarranted."

Although the State Department has announced that negotiations with the Australians have been concluded, it said the agreement has not been signed, pending approval of the Australian government regarding U. S. interests.

Corners Reaction

Representatives of U. S. airlines, however, are concerned and they could see little value in the route agreement and insisted that the Civil Aeronautics Board would approve applications for service on the proposed routes before, at present, most of them appear economically unworkable.

The route to Australia via the South Pole, for example, is several thousand miles longer than the routes now flown by Pan American World Airways and Qantas across the Pacific and therefore would attract little traffic.

In addition, the application will, even if the route were economically feasible and the CAB did approve U. S. interest on these routes, such routes might never be inaugurated by these authorities since would be recent from other companies since other companies are needed. From past experience, it might prove difficult to restore such authority in some instances.

Therefore, airlines in the regional exchange would allow Qantas to carry

traffic from San Francisco to Europe, then onwards, would tend to New York via domestic carriers.

A large portion of that traffic at such low fares would threaten the transatlantic airlines' policy of flying to Europe and the majority of that traffic would be carried by Pan American from the West Coast to New York and beyond to London.

A strong protest was made by American Airlines, which has long sought authority to fly carriers from San Francisco to New York. Pan American has also protested that the State Department has offered to grant foreign airlines to fly across the U. S. for a round-the-world route when Pan American is not yet permitted to fly across the U. S. to land its global service.

KLM, the Dutch airline, also has authority to fly around the world. However, it has not implemented its Tokyo-Honolulu-San Francisco route.

CAA also is reportedly suffering more extensive air rights from the U. S., including routes to both the east and west coasts and beyond to Canada and Europe.

Germany, Australia Sign Air Agreement

Rome—German Airlines are expected to sign an agreement with Australian Airlines to establish a route from Germany over England and the Middle East to Darwin and Sydney.

Qantas Empire Airlines in turn may focus Australia to Frankfurt and on to Holland and England under the agreement.

At the moment, Deutsche Luftfahrt



Northeast's First Britannia Flies

First Bristol Britannia for Northeast Airlines takes off for its initial flight at Belfast, Ireland. Aircraft was built by Short Brothers and Harland, Belfast, and delivered after its first flight to Belfast for flying out. Northeast has five such planes.



NIGHT AND DAY...A FULL-TIME MONEY-MAKER

the new "double-deck" jet-prop VANGUARD

With its unique "double-deck" fuselage, the new Vickers Vanguard is designed to be a money-maker round the clock. For during periods of low passenger traffic, the Vanguard can be operated profitably as a freighter!

With four Rolls Royce Tyne jet-prop engines, the new Vanguard will be capable of speeds up to 425 mph and will have a 2600-mile range with full payload into each Vanguard will be built over 2 million hours of Vickers jet-prop experience. Experience has no substitute!



DOUBLE-DECK FUSELAGE

Upper fuselage passenger cabin designed for maximum flexibility...for 75 to 100 passengers. Lower fuselage cargo hold and aft lower fuselage hold 125,000 lbs payload can be carried in two main cargo holds. Each hold has a 14' wide door to speed loading, unloading.

jet-prop **VICKERS**
VANGUARD

FOR MORE AT YOUR NEAREST AIR SHOW
V. S. Armstrong, Gloucester Station
10 Redcliffe Place, New York 26, N.Y.

cannot make use of this agreement due to these limited number of planes. But Qantas maintains one week flight Frankfurt/Edinburgh and return which will be continued under the new agreement.

Colonial's Integration Completed by Eastern

Integration of Colonial Airlines into Eastern Air Lines, approved June 1, 1956 by President Eisenhower, has been completed. Eastern announced last week. The Colonial Division of Eastern, the new unit had been called since Eastern's acquisition, now has become the Northern Division of the carrier.

Eastern says it has invested \$31.5 million in modernizing the former Colonial service and fitting it to Eastern standards. Some \$20 million of the total was attributed to replacement of flight equipment by retrofitting DC-7s and DC-7Cs and substituting Cessna, Cessna, Beech, Cessna, and Martin 404s. Remains of the company went into new ground facilities and personnel training, according to Eastern.

The airline's payroll has been increased by \$400,000 annually, it reports.

Port Says Air Force Hinders Civil Growth

Portland, Ore.—Help in solving the problem of port overcrowding and craft operations at Portland International Airport has been requested of the Airport Use Panel by the Port Commission here. In a letter to Civil Aeronautics Administration's Western Region asking for a reconsideration of the commission and the nature of air traffic and commercial operations at Portland was not confined to normal growth in air traffic operations of a civil airport.

The commission also protested to CAA Administrator James Pyle that the Air Force is holding up action on the port's request for port facilities from certain government rights of access at the airport. Air Force, the commission charged, is delaying stating its position in the matter to CAA so the Air Force can use its interest in negotiating for additional requirements of the airport.

The problem of port use and of its expansion are not related, the commission pointed out. Sometimes of the airport problem was pointed up in an American War report (May 27, p. 46).

Concerning the alleged Air Force stalling in the matter, the civil commission told Pyle "the Air Force delay is hindering the full development of civil aviation in this area."

AIRLINE OBSERVER

►United Air Lines representatives are considering purchase of Lockheed transport from Douglas aircraft. Airlines are reportedly considering 38 DC-71s powered with Rolls Royce Tyne engines. Price quoted by Douglas is based upon an initial sale of 40 aircraft. Grumman DC-30 designation has been abandoned because Douglas hopes for greater contribution in continuing an established sales (AW June 30, p. 44). Cargo version of the aircraft is DC-71A. Capable will be approved by adding 1,000 miles an hour out of fuselage constant section, 40 miles aft and by splitting loading down the middle and inserting stretch sections on top and bottom. Vertical fin will be except, presently for appearance.

►Allegiance-Mohawk merger possibilities have been revived, but most observers feel such a move may meet resistance from the Civil Aeronautics Board. The Board has issued no policy statement on its decision in the North Central-Lake Central merger case, but there is a good chance that it disapproved the proposed merger because of its unwillingness to allow too great an expansion of individual local service carriers.

►Greater Miami Aeronautics Assn. has proposed the construction of a central Miami airport for jet transport operations. Group recommends the filling in of land as a part of Brown's Run, between Miami and Miami Beach to permit airway traffic as a means of eliminating the noise corridor.

►Civil Aeronautics Administration has let a \$9,777,287 contract with Boeing-Carver Division of General Dynamics Corp. for 261 sets of turbine engine and control equipment. Turbine engines will be used in the T-100 transport with the 100th engine in July 1, 1959. Turbine engine equipment, which the sets in the CAA contract will increase, is under government by the Navy at an approximate cost of \$10 million for 213 dual engine and accessories.

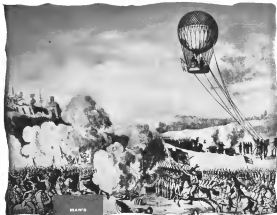
►Large singular air carrier investigations has been requested by the Civil Aeronautics Board with a bill for funds by July 15. Scope of the case will be confined to the fitness of the individual carriers and determination of whether airworthiness should be granted by inspection or certificate. Filing of bills is the final step in the complicated case before civil arguments are heard.

►Trans World Airlines President Carter Rogers has announced an end to personnel layoffs provided the airline continues to show improvements in operating results. Out of 20,000 employees, the airline has increased 500 since January for a complement reduction of 2%. Rogers demands a profit for TWA and has reported a modest decline in operating losses during the first four months of the year. Percentage of scheduled miles operated for the airlines in March was 99.5%. High load continued in April and May with 99.1% and 99.7%. During May, airline departures reached 92,105.

►Iberia Air Lines of Spain is operating a weekly charter service from Madrid to Canada as a means of maintaining an even balance of transatlantic traffic. Charter aircraft which carry Spanish agricultural products from Madrid to Canada are returned to scheduled service on New York-Madrid flights. As a result, Iberia is now operating two west coast scheduled flights weekly and three east coast flights.

►Defense Department has declassified a total of 13 AN/APN Doppler radar equipment for civil use.

►Last ditch fight is U.S. carrier against rival of U.S. routes to KLM Royal Dutch airlines in offering nonstop service. In a separate action, The American World Airlines filed a petition with the Civil Aeronautics Board for permission to reference in CAB proceedings assuming the grant of a first class route to KLM. No precedent exists for a board decision contrary to the terms of a bilateral treaty and there is little likelihood that the Board action will be denied its foreign carrier permit despite its action to U.S. airlines.



MAN'S
CONQUEST OF
THE AIR



First aerial observation of battle

Undoubtedly an important factor in the victory of French forces at the Battle of France in Belgium in 1918 was, believe it or not, aerial reconnaissance. For in this battle Captain J.M.J. Guéneau—later known as "Capitaine d'Aviation"—became the world's first military balloon observer. For hours Guéneau's balloon hovered over "no man's land" and even over the enemy's lines. With signal flags he sent a continuous relayed vital information back to the French Army Command.

Guéneau continued his aerial reconnaissance for Napoleon at Marston in 1796 and elsewhere. But in Egypt, where he had been ordered in 1798, his balloon equipment was badly destroyed in a naval battle. Man's conquest of the air has come a long way from the precarious balloons of yesterday to the sleek, earth-crushing jets of today. Since the advent of powered flight, Esso research has helped speed the progress of aviation by creating new and improved fuels and lubricants for military and commercial aircraft.

8 OUT OF 10 OF ALL THE WORLD'S INTERNATIONAL AIRLINES USE



AVIATION PRODUCTS

SHORTLINES

►United Air Lines reports a record May for passenger and cargo traffic with 401,674,000 passenger miles flown, an increase of 6% over May, 1956. Freight totaled 5,452,000 ton miles, up 36% over May, 1956, if 8 mail climbed 67% to 2,548,000 ton-miles.

►American Airlines also established new May records with 442 million passenger miles as compared with 410 million during May, 1956. American set a new domestic industry record in cargo ton-miles for our month with 30,500,000 in May, surpassing the carrier's own record of 7,515,800 set last October.

►Air France has added Toulouse to its FarneHong Kong route. Lockheed Super G Constellation is being used on the flight, which leaves Toulouse on Tuesdays and returns from Hong Kong on Saturdays.

►Ghana is the latest nation to join the International Civil Aviation Organization. The new nation becomes the 71st member nation in ICAG.

►Midwest Airlines reports that traffic operations for May were 9.7% and 14.5% above May of 1956 in passenger and passenger miles respectively. The carrier carried 36,016 passengers and flew 6,747,672 passenger-miles.

►Sobona will offer helicopter tours from Paris through the Great canyon of France beginning July 14. The Soberon team will continue through the summer and will offer low altitude views of some famous districts in the area including Chamon, Evry, and Chaudard. Sobona will use Sikorski S 55s on the tour.

►Michigan Municipal Winter Commission approved the use of 50 510-029 in concrete blocks to construct a terminal building at the W.A. Coast Airport near Detroit. Winter Coast Road Commission will handle the land work.

►Council of the International Civil Aviation Organization recently approved three "forward scatter" radio stations and a new "Adaptive cable" is to be installed to provide a direct voice and four telephone communications channels between Europe and North America. The cable will be laid between Pittsburgh, Scotland, and Liverpool, England. The forward scatter stations will be built near Nazam, Greenland, and Gander, Newfoundland, to complete the network.

COCKPIT VIEWPOINT

By Capt. R. C. Nelson

A Stitch in Time

Airline planning for the operation of turbine-powered aircraft is, in itself, a complex, moving ahead at a fast pace. In many airline departments there is considerable anticipation over the prospect of the new first. But there is also a distinct feeling among many advanced people outside the transport business that our airlines do not fully realize the magnitude of their new venture.

Considering the aircraft themselves, the DC-8, the 707, the 440, the Electra, etc., there appears no concern for them. The manufacturers currently have the time to produce safe vehicles. It is the timing of all these aircraft to the existing traffic control and airport system that causes the greatest concern. These too get a new base of data to aviation operators and controllers, a certain amount of shockwave time will be required to use out the kinks.

The length of our trial and error period could obviously be reduced if we knew where to look and what to look for. And, just as obviously, advance information can come only from those who have been operating into-the-military.

Much to Learn

It is true that military and military operations are a somewhat different nature. But this does not minimize the fact that much could be learned from people who have flown jets for a decade or more. The aviation has to find things out the hard way since they were essentially proceeding. It would appear that the airlines might gain as much as they could from this, perhaps by training in detail the experience of the military.

What can be learned? Possibly a great deal. There are many ground handling and servicing items which may require different techniques than in the past. There are runway and ground surface (ramps, taxiways, etc.) requirements which may need special attention, i.e., the problems of debris, snow, and just as surprising, the Airlines may find that better planning, both airport and dispatch practices will need revision. In-flight items include some of the differences—knowledge about meteorological data, winds, and turbulence aloft, turbulence and icing, etc. The operation of turbine engines is an entirely new field for many airlines.

To some extent the entire subject appears to be more a question of degree than of kind. While it may be true that the pilot is not another type of aircraft it is also true that in some cases their demands are as much more exacting than those of their ancestors that past methods simply will not suffice.

Military Files

The most question is, "How do we gather this information?" Our government recently brought to my attention is that the entire operation should be organized to examine the accident and incident files of the military. A joint committee composed of representatives from the various aviation departments might be able to correlate the factors leading to military accidents with airline accidents and alert their management to possible danger areas. It will of course be imperative that these investigations have a thorough practical knowledge of present airline operations in order for them to spot potential situations.

The public, as well as the air transport community, is looking eagerly to see what happens. One way to make that transition as smooth and safe as possible is to be prepared. How can we better prepare ourselves than by reviewing the trials and tribulations of others? An accident research program might be well worth the effort.

Here's Why General Electric's New BEST POWERPLANT

T58 Turboshaft Engine Is The FOR HELICOPTERS



HOW BEING FIRED-TESTED is a modified Sikorsky HO4S helicopter, the T58 engine delivers more than 3080 horsepower, yet weighs only 449 pounds.



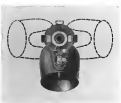
T58'S ADVANCED CONTROLS, FREE TURBINE DESIGN help simplify pilot duty, allow the



T58'S MAIN REDUCTION GEAR permits constant free or aft power extraction.



helicopter rotor to operate at best speeds for climb, cruise, or hover conditions.



T58'S 3-POSITION EXHAUST NOZZLE mounts vertically or at 50-degree angle.

Offers unmatched performance capability; advanced mechanical design features

Over 3:1 Power-to-weight Ratio—Packing more power per pound than any other gas turbine engine of comparable output, the T58 delivers 1014 horsepower yet weighs only 325 pounds (including 75-lb reduction gear). What will the T58's low weight mean to future helicopters? Dense reductions in their gross weight—up to 40% faster cruising speeds—greater endurance—and vastly increased ton-mile capacity. In addition, the T58's advanced aerodynamic and lightweight mechanical design promises the same high reliability that has been proven in G.E.'s J47, J71, and supercruise J79 jet engines.

64:1 Specific Fuel Consumption (normal, with gear)—The T58's turbine inlet temperatures, pressure ratios and the aerodynamic design of its major components have been balanced to provide the highest possible operating efficiency over a wide range of helicopter flight conditions. Result: a proven SFC that rivals the piston engine for economical operation.

Automatic Rotor Speed Control—The T58's revolutionary new constant-speed control eliminates the need for speed adjustments by the pilot during normal flight operation. Combined with the T58's free power turbine, this new control automatically regulates engine output to meet changes in load or flight attitude, thus permitting the helicopter rotor to operate at the most efficient speeds for take-off, climb, cruise and hover.

Small Envelope Size—Measuring only 59 inches long by 16 inches at maximum base, the T58 makes possible more compact engine compartment design, additional cargo space.

Variable Exhaust & Power Take-off Arrangement—The engine's 3-position exhaust and free or aft power take-off arrangement also simplifies problems of designing or retrofitting engine compartments in either single- or multi-engine helicopters.

The T58 was developed for the Navy by General Electric's Best Aircraft Engines Dept. General Electric believes the T58's many features make it the best engine of its kind to transform the role and performance of helicopters into new levels of military and commercial usefulness. For detailed performance data, call your local G.E. Aviation & Defense Industries Sales Office, or write: General Electric Co., Section 333 S, Schenectady 3, New York, for T58 brochure.

Progress Is Our Most Important Product

GENERAL  ELECTRIC



ONE OF FIRST U. S. aircraft to have blunt airfoils was the Bell X-2 (above). The French Nord Gerbier II and Red Arrowon Bessardier also use blunt-tail control surfaces.



CHANCE Vought F-106 (above) has blunt airfoils to improve transonic stability. NACA modified F-88 (below) to obtain transonic flight test data on the blunt concept.



SUPersonic airfoils typical of those being tested by the NACA. Each has the same thickness ratio. Upper airfoil is a conventional, however, from which is compared with blunt shapes below. Differences among blunt trailing edge airfoils are due to varying design Mach numbers and structural requirements.

Bluntness

By J. S. Betz, Jr.

New York-Bluntness can be an aerodynamic asset. Compared to conventional streamlining concepts and even early supersonic theory, blunt rather than sharp edged wings and rounded rather than pointed noses can be the most efficient for supersonic and hypersonic flight.

Pioneered as it may seem, NACA experiments show:

- Minimum drag airfoils have blunt trailing edges from Mach 1.5 to 5.0 and indications are that this is true of much higher Mach numbers.
- Lift is improved at all supersonic speeds by use of a blunt trailing edge airfoil.
- Aerodynamic heating of a wing may be reduced by rounding its leading edge. This is also true of an aircraft or missile nose.

• Stabilities of an aircraft may be improved at transonic speeds by using blunt trailing edge wings and control surfaces.

• Blunt nose shape is the most effective configuration for keeping aerodynamic heating low on very high velocity objects of the size and weight of a cannon BCRM warhead during reentry.

Fundamental nature of this NACA information indicates its value to the aircraft industry in practicing the various possible approach to aerodynamic problems. The work on blunt trailing edge wings was led by Dean R. Chapman, and that concerning reentry was directed by H. Julian Allen. Both are with the Ames Laboratory.

The latest display of its usefulness

AERONAUTICAL ENGINEERING



BILE RASCAL strato-sonic airfoil shows blunt trailing edges on its forward and aft wing panels to improve stability during high angle of attack maneuvering. Lower fin is folded during transport on dolly. Upper fin also will fold.

Can Add Efficiency to Aircraft, Missile

any at the Paris Air Show when blunt trailing edges appeared on French pen bays (AW June 10, p. 26). Blunt airfoils seen at the Nord Gerbier II and extended angle plates on the Nord Bessardier missile.

Blunt Trailing Edge

Several fundamental differences between subsonic and supersonic lifting and airfoil characteristics make it possible for the blunt trailing edge airfoil to attain superior efficiency above Mach 1, or, contrast to its poor subsonic lift and drag qualities.

Zero-lift, or minimum, drag of a subsonic sharp trailing edge airfoil at Mach numbers well below our results presents from skin friction. Pressure is more drag of this airfoil is low because the long potential shockwave humps the flow separating point and back to the chord and reduces the wake. The only effect of blunting the trailing edge would be to create a base pressure and increase the total drag.

In supersonic flow the pressure drag of an airfoil depends to a great extent upon the magnitude of the angle between the surface and the chord line (angle A, right). Angle A and consequently the pressure drag of an airfoil of given chord and strength can be greatly reduced at the point of maximum thickness as is noted in the trailing edge.

Even though the air of thin shape sections that pressure or wave drag it obviously has the disadvantages of creating a large base drag. With needed design that disadvantages can be overcome for it has been proven the added base drag can be less than the reduction in

wave drag achieved by moving the point of maximum thickness aft. The supersonic drag savings realized upon airfoils with blunt trailing edge designs have exceeded 30% for 30% shock wave critical Mach 2.

The problems inherent in choosing the best airfoil to meet a given set of design requirements are too involved to make general statements regarding the superiority of any given airfoil shape. Aired section, position of maximum thickness and base length are dependent on an area, design factors such as structural requirements, desired lift drag ratio, design Mach number, pitching characteristics, heating rate, etc.

For that reason, experimental blunt base airfoils which the NACA tested were designed to simplified specifications which closely approximated our very supersonic drag requirements. In the typical test comparisons were made of several sets of conventional to

convex and double wedge supersonic airfoils and blunt trailing edge shapes which were all designed to give maximum wave drag. Each airfoil is a set and the same thickness ratio and design Mach number and offers a specified bending or torsional strength. Comparison of the drag coefficient of the various airfoils in a set was to indicate whether blunt trailing edge airfoils had application in normal design work.

Test Confirmation

The results of these tests showed that double drag improvements at supersonic Mach numbers were possible using blunt trailing edge airfoils. NACA found that:

- Drag reductions achieved by blunt trailing edge airfoils decreases as shock wave angle decreases.

This is because the percentage of wave drag is total drag decreases with thickness ratio.

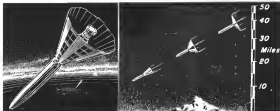
• Profile drag reductions grow smaller with increasing Mach number. This is apparently because the ratio of wave drag to friction drag decreases with Mach number. Successful reduction in aerodynamic heating and friction drag at high Mach numbers could still make blunt trailing edges effective at very high Mach numbers.

- Base pressure is low and therefore aerodynamic heating of the base is reduced and its thickness is large compared to the base height.

Particular care must be exercised in keeping base pressure low on blunt trailing edge airfoils for air below Mach 2. The base drag, the drag



PRESSURE or wave drag of supersonic airfoil is very sensitive to angle A (above). Moving maximum thickness to trailing edge results in reduction in total wave drag above Mach 2, according to NACA tests.



VARIABLE GEOMETRY low cone allows it sample of NACA xi-cone design suggestion. The type of workload could have controlled speed and deceleration history and eliminate the low terminal velocity and severe deceleration of the spindly workload. Aero dynamics loading could also be kept low enough for known outside and cockpit stresses.

behind are blunt base, could be 75% of the total drag at a 1% thick orifice at Mach 1.5 if the base pressure were a vacuum.

The key to this whole drag approach is to keep base drag low. Studies of the boundary layer at the trailing edge have been started to optimize its effect on base drag. Various heat transfer arrangements are also being tried.

One of the most promising means of reducing base drag is bleeding air into the low pressure air dead air space behind the sub. Results of this approach indicate that 75% reduction in base drag are possible up to Mach 2. Data beyond that speed are not presently available. Minimum alleviation of base pressure occurs when the total pressure of the bleed air is 75-80% of the ambient static pressure. The current rate of bleed air flow required to achieve these results is not large and it disappears at subsonic velocities.

Trailing edge bleedlines have just as beneficial an effect on lift as it does on drag at supersonic speed.

There again basic differences between volume and expansion flow principles indicate that a significant effect should be a wedge shape.

In subsonic flow the lifting efficiency of an airfoil depends on its camber as constant, its thickness ratio, and the condition of the boundary layer. None of these factors have a major effect on supersonic lift. In fact, the expansion fan lift over a shape at supersonic speeds can be reduced to a function of only trailing edge thickness ratio and Mach number, and it increases at three to five times increase. This expansion fan lift curve slope was postulated and proven experimentally in the 1910s by Busemann. It was verified by NACA.

The advantage of blunt trailing edge wings, proven in the NACA subsonic

that significant improvement in supersonic lift/drag ratios and consequently aircraft range is possible is not probable. The lift improving benefits at the blunt trailing edge continue to increase with Mach number. If there are found to decrease below drag above Mach 5 then a subtle extension of the blunt trailing edge) was drag reduction is possible. Also, the structural advantages of a blunt trailing edge wing are obvious as it eliminates a very slender section which is most difficult to manufacture and design.

Trailing edge bleedlines have also been of use in improving the stability of swept wing aircraft especially in the transonic regime. NACA flight tests with a modified F-88 illustrate the advantages of blunt airfoils. Although blunt trailing edge control surfaces were used on other aircraft two of them were the F7U and the X-2.

Two of the stability problems associated with a swept wing aircraft are pitch up and wing dropping or roll off. Pitch up occurs when the flow on the outboard portion of the wing separates and the wing center of pressure moves forward and forward. Roll off is caused by an asymmetric flow separation on the outer wing and the second of alpha control for small deflections during separation.

NACA work towards improving the yawing stability of the P-56 is similar to industry efforts, and it also provides an interesting view of some of the flight limitations of the Air Force's best fighter of a few years ago. Tests with the F-56 showed that separation occurred mainly on the forward part of the outboard wing up to Mach number of 0.6. At and below this Mach number, pitchup took the form of a virtually uncontrollable stall at moderate angles of attack. The solution was provided

an outboard leading edge extension. In the Mach number range from 0.5 to 0.8, pitch-up on the F-56 occurs because of separation on the air portion of the outer wing. Several methods were tried to prevent this separation, such as wing fences, vortex generators, and leading edge extensions. Each device helped the situation but none were as effective as using blunt trailing edges on the ailerons, which are outboard and in the region of separation.

The blunt trailing edges prevent separation by the simple means of decreasing the trailing edge angle to reduce the build up of the adverse pressure. The modified airfoils, though no perfect, greatly reduced the violence of the pitching, delayed it until a higher Mach number, and made it possible to keep control of the aircraft under higher acceleration loadings. They began to lose effectiveness as coming the 1.6's pitch-up troubles in a region that was at the elastic upper limit of the aircraft's capacity.

Roll off, which has been bad on the original aircraft from Mach 0.8 to 1.0, was virtually eliminated by the increased effectiveness of the blunt ailerons. The aileron hinge moments were increased but not beyond the capacity of the original control system. The drag of the blunt ailerons amounted to about 0.01 below Mach 0.9 and was none above that speed.

The equilibrium temperature and the heat transfer rate at an airfoil surface in high speed flight may be reduced by delaying the transition from laminar to turbulent flow in the boundary layer. By smoothing the leading edge is preferred to keeping a sharp edge; this data has been obtained.

Rounded nose shape creates a detached shock wave in front of the wing which weakens pressure drag. However, it



Airfoil designs, some 1000. An innovation of test designers, it never got off the ground.



there's a difference in hose assemblies, too!

for example, take: **BLOWOFF-PROOF FITTINGS**

There is no question that the Blowoff-Proof permanently swaged (yet field attachable) fittings designed specifically for Fluoroflex-T have proved not only leakage but also risk of blowoff. Millions of feet of Fluoroflex-T hose assemblies on both military and commercial aircraft plus years of service demonstrate the inherent reliability of these fittings. The reverse side of this page describes its engineering excellence in further detail.

RESISTOFLEX

FLUOROFLEX-T

hose assemblies

Proved leakproof in over three years of service!



FLUOROFLEX-T America's most advanced hose

- The Original Fluorocarbon hose
- Patented tube compound
- Keeps its life
- Undergird "Swivel end" fittings
- Over three years flying time
- Super impact life
- Willows at hot air tanks
- Patented integral construction
- Self supporting
- Service ground construction to 5000 psi

• Fittings for Fluoroflex-T hose meet the two most important requirements for systems conveying fluids under pressure: 1) they do not leak; 2) they do not blow off.

Fittings are rugged to both wire-bond and tube. Compression on tube and "crimp" of fitting are kept constant by a unique design feature (patented, pending). No cold flow which may occur in the tube is compensated for and actually helps maintain the seal. None of the right or wrong in all types of military and commercial aircraft have demonstrated the inherent reliability of this design.

Obviously, leakproof fittings are a vital requirement for aircraft. Unlike ordinary "do-it-yourself" fittings,

Resistoflex's security winged couplings eliminate the risk of human error in assembly—provide the safety factor which is the very minimum necessary. This feature, too, and every equipment should have the protection.

VITAL FACTS ABOUT FLUOROFLEX-T

Fluoroflex-T hose starts with Tyfloc powder — a new material which, in the end product, can be made to vary greatly depending upon the fabricating methods involved.

Many years of research and testing were required to solve the unique problem of Fluoroflex-T tube which alone provides the life-time necessary for the maximum degree of protection.

Millions of feet of this hose are in service—proof of its reliability.

In addition, Resistoflex employs fully compliant safety factors built into Fluoroflex-T hose. They are designed and allowed-proof.

In a recent test made from "Teflon," the fabricator's experience and integrity remain the same as the engineer's best assurance of reliability and performance. Resistoflex, not only originated hose from Teflon but developed the patented Fluoroflex-T tube.

If you have any question whatever on the performance of hose made from Teflon, you can get the right answer, constructively expressed, from Resistoflex.

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Originators of high temperature fluorocarbon hose assemblies

Resistoflex

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also counts a low Reynolds number and low Mach number upon the internal surface of the wing which is a good environment for a laminar boundary layer.

NACA then shows that the transverse point source distribution is a factor of 2 at Mach 3 in wing the least case. If the theory continues to hold true at hypersonic speeds, with its air accelerated at five and a half times the speed of sound, the transverse will move downstream to a factor of 30 at Mach 15.

The pressure drag caused by rounding the leading edge is low at supersonic speeds if the roundness is small, says.

The great saving in friction drag possible with thin wings would indicate there is a possibility that hypersonic vehicles will have rounded leading edges and blunt trailing edges.

In their generalized report on losing problems and re-entry configurations, H. John Allen and A. F. Eggers, Jr., reached several basic conclusions. One concerns the shape giving the lowest total heat absorption for a vehicle nose cone at re-entry speeds up to 30,000 ft/sec. The proper shape for a light nose cone which could be pulled in a corner (ICBM) is blunt, in the sense of a sphere. A much heavier nose cone would require a long, slender shape. A thorough study of the problem at higher speeds is not possible because of insufficient knowledge of the properties of dissociated air (AIAA June 25, 1955, p. 16; July 2, 1955, p. 47).

Another aspect of the problem which they studied was the rate of heat input for each proposed configuration. This factor is very important because the surface of the nose cone skin can



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The Gerotor also mounted on fixed rotors consists in each other. As they turn, the chamber between the teeth of the inner and outer Gerotor gradually increases in size through the initial part of revolution until it reaches the full volume of the chamber tooth.

During the first half-revolution, the gradually enlarging chamber passes the intake port, creating a partial vacuum which draws fluid from the port tank.

In the second half-revolution, the tooth mesh, decreasing the size of the chamber as it passes the discharge port, forcing the liquid out.

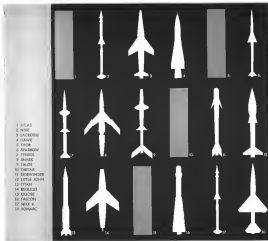
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Plan View of T-38

Further details of Northrop T-38 supersonic trainer are shown in this article's accompanying illustration. The view shows also side fining and turbidity straight wing set well back. Two turbopump engines will power the trainer.



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leading edge. The propensity to air theoretical study comparing airfoils with sharp and blunt leading edges was better knowledge of the process existing behind a blunt base at supersonic speed.

Little Data

Very little data of this kind was available in the 1940s, as Chapman wrote. The subject of his documents then at California Institute of Technology. But then in 1949 indicated that so slender the blunt leading edge was lost. Since March 2. Subsequent work by Chapman and other NACA scientists has continued to give credence to the original idea. Studies have also been made in Sweden by Georg Doering concerning the design of blunt trailing edge wings which have maximum pressure drag and also satisfy great requirements of bending and torsional strength.

Simple Blast Fence Cuts Noise 15-20 db.

Simple, low cost blast fence can meet an estimated 15-20 db. in reducing high charge boundary layer from packing gun magazines up through the rest of the blast. The fence is a quarter cylinder of corrugated steel with the inner surface facing the blast. It is mounted upon a structural iron base, two fence with the present layout to the curve of the blast coming out. All attachments including the sections to the present are made with a single use of bolt and nut for the sake of standardization. The fence is made by Lynn Engineering Co. of San Jose, Calif.

The design is based upon engineering studies showing that as blast spreads as a curved area off of the tail pipe, its bottom edge is reflected and accelerated by the pressure. In a distance of 15 feet, this boundary layer can reach three times the velocity of the blast at the entrance. The fence deflects the high speed layer through an arc of 114 degrees to blow back upon the greater part of the jet efflux and then it spreads.

Each plate prevents pressure from spreading toward the base.

Water cooling heads are workable if the noise must be reduced the least of substances.

Douglas Aircraft, El Segundo, is using one of the fences and reports that it works satisfactorily. The current price of fences that are six feet high at the upper edge is \$14 per foot. The maker believes the price could be reduced to \$16 per foot if sold in quantity.

Though height of the fences is not considered an important parameter, an equivalent version is being studied.

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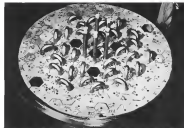
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AIRCRAFT POWERPLANT nuclear test experiment 2½ years ago (AWE May 27, p. 27). Large tube at top of 33 in. diameter neutron reflect (NR) is for the sodium heat exchanger; smaller sodium reflect (SR) is for the sodium heat exchanger. The other pipe in the center is for regulating and control rods. The reactor, probably part of a joint Ford & Whittaker-Ridge project, first became critical Nov. 3, 1954 when sodium coolant, into flooded concrete was added to the sodium flood; this being contained around the power loop. Top of reactor core (right) shows the 16 tubes which circulated the sodium fuel through the fuel element rods and sodium coolant in separate loops. Six oxygen pipes in the center are fuel inlet tubes. The low hydrogen disposal holes around the fuel inlet pipes are for regulating and control rods, and two holes near the top are for the sodium neutron reflectors.



Nuclear Airframe Designers Lose Conventional Load Tools

By Russell Hawkins

Los Angeles designers of nuclear aircraft will lack many of the tools by which structural loads of conventional planes are related and structural loads are used, the chief of Lockheed Aircraft's W-115A nuclear bomber projects told Institute of Aeronautical Sciences members at a recent meeting here.

An important loss to the designer will be the general practice of distributing weight along the wing, as possible in a nuclear plane because of its fuelage-mounted powerplants and landing gear and little or no demand for structural fuel, according to a paper by F. A. Cleveland, head of the bomber program at Lockheed's Marietta, Ga. Division and C. E. Johnson, the company's vice president, research and development.

Bomber First

Two and other special considerations in the design of nuclear airplanes were outlined in the paper presented by Cleveland who said the strategic bomber is the logical first application for nuclear aircraft power.

According to the report, three characteristics of the nuclear plane cause

the probabilities of its airframe design:

- Concentrated weight.
 - Reduced fuel.
 - Absence of any important range limit.
- The first two characteristics raise a lot of problems compounded by the obvious and overwhelming benefits of the third. A secondary benefit is the nuclear bomber's relative invulnerability to bullets due to the absence of the vast quantities of combustible chemical fuel carried by conventional aircraft.

Concentrated weight of reactor and sodium shielding can be mitigated by dividing shield so that part surrounds reactor and part surrounds crew with a large separation between to absorb radiation with distance. Shielding can be reduced by careful use of wing box, landing gear, payload and the small amount of chemical fuel which is likely to be needed because of special advantages in certain regions.

The designer's approach to weight and balance is altered by the greater readiness of components and subunits to compete for space in the fuselage near the center of gravity. Reasons for migration of weight from wing:

- Reactor, shield assembly and subunits access for crew hold the equipped empty weight of the airplane.

• Reactor must be near the CG, because of its great mass.

• Nuclear fuelpods may be mounted in fuselage as well as possible to react but to ease the difficult problem of heat transfer from the reactor to the heat exchangers which replace combustion gas of conventional turbojets.

• Much of heavy shielding needed to protect crew and equipment from radiation must be located near reactor.

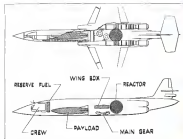
• Thin wings needed for high speed flight and absence of engine nacelles force landing gear into the fuselage where they must be located near CG to increase weight of supporting structure and to control impact loads on nose wheel.

• Wing must pass through fuselage near CG unless it is designed with counterweight back to carry the mass here forward. Cleveland does not consider this a sound engineering approach and showed a slide of a nuclear aircraft with a low aspect ratio, straight wing, planform reminiscent of the F-104.

• Disposable weight, which includes bomb load, must be carried near CG to limit CG travel.

• Resultant fixed equipment tends to spread out in the fuselage and can't be of much help to the designer as rebalancing.

• If shield is divided with part near reactor and part near crew compartment is used, the designer uses 120 weight proportion to control balance. Because of the density of shielding, this



IDEALIZED PROFILE of a possible nuclear bomber, indicates configuration of several centers of gravity. Most feasible layout, Lockheed layout, is to have engine close to reactor. Here fuel engine are mounted in gress on each side of fuselage, wing engine short the other. Wing box, landing gear also are for position at CG.

is a powerful tool, but one which the designer cannot use freely without affecting the primary purpose of shielding. The reactor shield assembly weighs from 25,000 lb. to 100,000 lb. with a density of 160 lb./cu. ft. to 200 lb./cu. ft.

Shield design which also provides the best crew protection must be one factor of problems. The designer is not free to choose the best separation distance for crew protection. Carried to extremes, this would create impossible aerodynamic and structural problems. The necessity of carrying out shielding at all in the nose would force weight distribution along the fuselage from the structural standpoint and it would become structure to cope with static loads.

In which also cause low frequency fatigue vibration modes raising for yet heavier structure.

Stability Problems

Concentration of mass at two widely separated points along the fuselage could also be expected to cause serious moments of inertia against pitch and yaw. The effect of moments in these two areas probably would not be great but must be considered.

One result of the development of the nuclear propelled aircraft will be the loss of the means by which designers now achieve structural loads and use structural weight in conventionally powered aircraft by distributing much weight along the wing. This reduces weight which increases the bending loads

on the wing root which would exist in flight if the weight were concentrated at the fuselage. Engine pods, external wing fuel tanks, big tanks, wing-mounted armament and wing storage of landing gear all contribute to this end.

The nuclear aircraft will not benefit from this approach. Consumption of chemical fuel in flight and means to discharge them in emergency has been an important means of structural relief in the airplane can be designed to light loading weights rather than heavy bolted weights. There is no important difference between the two in a nuclear aircraft and landing loads must be figured on the basis of carrying full oil gross weight. Fuel consumption of a conventional bomber also often a bonus at the target end of a flight in terms of speed, rate of climb and maneuverability.

Cleveland said it is likely that the engine of the nuclear aircraft will be designed to burn conventional fuel for some segment of flight. Response time of nuclear engine to changes of power setting may be too long to be relied on for takeoff or for a takeoff in this landing approach.

Two advantages accruing to the nuclear aircraft are reduced range of CG travel and transfer weights before or as an increase in useful load. The CG range of 12% MGV is considerably poorer than should be not to full fuel in use with the advent of nuclear power. The cost of an additional pound

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or payload as component in the fuselage aircraft should be 1.5 to 4 lb. of stress load increase compared to 5 to 10 lb. of load and vibration expense in a conventional airplane. The cost of an additional pound of drag can be too high in the same way and shows the same advantage for the welded joint and welds.

Much of the characteristics of the welded aircraft stem from the need to weld across the stress of induction. Much of present research in the field is aimed at defining these effects precisely.

Protecting the human crew is perhaps the most critical factor in design. Designing of efficient crew systems is made especially difficult by the conflicting demands for crew room with protection and for critical loads on weight. Each cubic foot of weight value costs from 70 to 100 lb. of shielding. Careful engineering has enabled engineers to shave the crew space allowance to 50% or 10 per cent but movement in such a space is not easy. Limited space and the pressure of the shield also make escape difficult in an emergency.

Shielding hangers visibility because some shielding is needed on all sides of the cockpit and good transparent shields are difficult to make. Radiation, whether of x-rays, neutrons or gamma rays, is highly directional and in a vacuum a thin plate shield between the source and the crew would provide adequate protection. However, both types of radiation may be deflected in much as 180 deg. by air atoms in structure. Since the energy of ionization decreases, in different angle increases, the density of the shield required decreases from front to back around the capsule of the nose. Intensity of deflected radiation remains great enough so that windows must be made of some transparent shielding material even in the case of windows of the windshield.

Human Limits

Setting human limits looks appear to be the most difficult task in the research leading to the welded airplane. Aside from the difficulty of predicting the behavior of the radiation, it appears that human body organs are sensitive to it in various degrees.

The lowest to the ground crew, will probably be more than that to the crew. Present indications are that the ground crew will be limited to the Atomic Energy Commission Laboratory Shunt Rate of 7.5 millirads per hour while the crew may be 10 to 100 times as great.

The reason for this is that whereas shielding down the reactor cuts induction by one order of magnitude or more, decreasing radiation permits at a harmful intensity for a time which will be

governed by the half-life of the radio active products. Because of the rapid initial rate of decay, a rest of a few hours before starting maintenance operations will allow enough to fall considerably. Finding good shielding materials for the ground crew is made easier by the fact that radiation after shutdown is almost uniformly gamma rays.

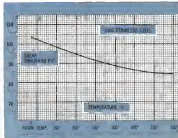
Better Solution

Remote controlled mechanical maintenance work elements based in machines but operated from above show a job that can be done as long as with direct vision. If closed loop television were used, it would be reasonable to expect a still longer time. A better solution may be to remove the operator to a special shop for maintenance work, leaving the surface available for normal work methods.

Cleveland and Johnson divided radiation damage by induction into eight fields:

- **Discontinuous changes independent of the stress on the part.** The damage levels stopped to produce these changes is such that it is a problem mainly within the reactor shield.
- **Acceleration of creep due to high stress levels and high temperatures.** If annealing, heating, radiation heating or heavy loads cause changes in the character of structural materials, the designer must take care not to let these changes be accelerated by subjecting the materials to heavy stresses.
- **Hardening and embrittlement by induction.** This may be an important design factor. Fortunately work hardening effects in the hardened condition are not much affected, but for pre-stressed fittings and components are the matter there is a possibility of gross ductility sensitivity and reduced impact strength.
- **Micro-diffusion of dissimilar metals at joining surfaces.** This may most embrittlement and other metallurgical troubles. It occurs because diffusion of atoms in metal is more rapid in the presence of radiation and is a special threat at welded or bolted connections between dissimilar metals.
- **Accelerated stress corrosion.** This too is caused by accelerated diffusion of stress in metal.
- **Transmutation under bombardment by slow neutrons.** Most metals are changed into other elements because silicon, copper becomes nickel and zinc and some metals become isotopes of the original metal. No structural materials become gas or liquid and the percentage of transmutation is probably less than the unknown equivalent in the original metal.
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Nuclear Plane Crew Hazard May Be Less Than Supposed

Devere-Rabinson based on the crew of a nuclear propelled aircraft may be less than originally estimated, but careful calculation of acceptable radiation doses will be needed to get best performance and utility from the crew, Aero Medical Association members were told at their annual meeting here.

Dr. E. L. Adams and Dr. C. M. Whitlock Jr. presented a paper which extracted material from Conway's official report on the current Navy-sponsored study of nuclear aircraft operational problems.

The study points out as a disadvantage of nuclear fuel that 15% of the energy released by fission is dissipated in the form of ionizing radiation which cannot be used for propulsion and which is sufficient quantities to be harmful to living organisms and to materials.

The authors suggest that because the amount of radiation required to heat the liquid core is less than that required to have nuclear fuel, the liquid fuel will be the controlling parameter to design of a nuclear powered airplane.

Limiting Hazard

The three obvious ways of limiting the hazard are by shielding the crew from the radiation source, by storing the fuel as far as possible from the source, and by reducing period of exposure.

All three have serious disadvantages. Shielding may cause weight and balance limitations to be exceeded; distance may cause propulsive design problems; and limiting exposure may reduce stage duration and the effectiveness of hard-together crews. These disadvantages demand the fastest possible calculation of acceptable radiation dose if performance and utility are to be optimized.

The National Committee for Radiation Protection recommends a 25-year average dose allowance of 100 mrad, which the authors believe may be too conservative.

There are three areas in which crew radiation affects the human body:

- By disrupting chemical bonds
- By upsetting electrical charges
- By imparting kinetic energy to tissue causing spots of extremely high temperature.

Radiation effects include three phenomena: reproduction and development, which are completely interrupted; the cells of the CNS are study indicate that as initial doses should not cause deterioration of adult males. Last is known

About the possibilities of stimulation in women.

The authors do not think a dose below the level considered lethal has any important genetic effects on succeeding generations. Statistical analysis of the reproductive history of cadet airmen who have served on crew doses of 1000 mrad or more and of survivors of the Hiroshima and Nagasaki bombings shows no significant increase in the likelihood of fetal malformations.

Decompression Sickness

Wing Commander W. Lockhead, RAAF, delivered a paper attributing deaths from decompression sickness to shock caused by embolism of fat from lymph of the viscera which is carried to the lungs and brain. He said that in the past 14 years 13 people have died after decompression in the United States and Britain and one person in Australia has suffered decompression sickness and recovered. None of the fatalities occurred after decompression chamber use and in other actual high altitude flight. In 10 of the total cases and in the one nonfatal case the victims were found to have fatty livers. No clinical or post-mortem findings were available in other instances.

Studies of the cases in which data were available indicate that the victims had low protein, high carbohydrate diet and low rates of ascent to vegetable protein.

In the single non-fatal case, an Australian pilot had been living on a strictly diet while serving in England when he came to die in a plane crash of low altitude. After decompression shock he was put on a high protein diet and gave up beer. He was later subjected to tank tests up to 57,000 ft. and returned to flying duty. A liver biopsy taken at the time of admission to the hospital showed marked accumulations of fat which had disappeared after the diet.

Loading Injuries

Capt. John K. Propper, USN, suggested a new type of restraint harness aimed at reducing the number of spinal injuries suffered by pilots. He said the wing back injury mechanism also caused by a relative increase in the vertical component of the force during acceleration on landing. Often the vertical component is one third or more times that of the horizontal. Shoulder harness pockets used previously against injuries due to forward acceleration but are ineffective against downward forces because they allow the body to slump enough to place high



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impact loads on the launch vehicle and permit the load to strike objects at lower level. Experiments have shown that a downward deflection of 25 to 750 is likely to cause a compression fracture or crushing of the inter-vehicle diaphragm. Even a substantial oscillation in an elastic system like the space ship, produce critical oscillations in parts of the system. This oscillation of acceleration at points in the space is dependent upon rate of onset and is produced by dynamic response between the upper and lower parts of the torso made possible by different rates of acceleration.

Independent Support

The solution recommended by Dr. Pappas is independent support of the upper torso to assure that it is neither steel seat-backs with the lower torso. He said that design and testing studies have already begun on a harness providing this support and that preliminary results confirm the validity of the principle.

In the same field of acceleration exposure to the space, John L. Hess of Douglas Aircraft and Charles F. Low, head consultant, showed studies indicating that in a normal 20G test cycle the spine is compressed about six inches. If one wears one less than 63 second, various parts of the body are subjected to considerably greater accelerations than the rest because of the dynamic response of the body.

Dr. Umberto Strupold of USAF's School of Aerospace Medicine, Randolph AFB, Texas, confirmed recent fiction written by reporting that human habituation of Man can only be exploratory and not permanent in atmosphere pressure and oxygen content will not support Earth-born life.

Pressure Suits

The search of wearing pressure suits at present breeding approaches would permit economic activity and protection. He said that the Pressurized Flight suit provides a reasonable analysis of many of the climatic characteristics of Man.

Course reduction, temperature and humidity are all virtually identical. Atmospheric pressure on Man is about equivalent to the Earth's atmospheric pressure at 55,000 ft.

Douglas Will Deliver Weather B-66 to TAC

Douglas Aircraft Corp. will soon deliver that WB 66D, weather reconnaissance version of its B-66 jet bomber to Tactical Air Command Airbase. Offers little extends less other version.

Powered by Allison T35 engines, WB-66D is produced at Tulsa, Okla.

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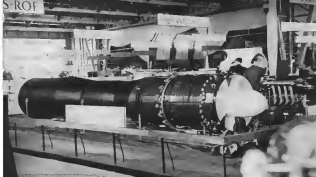
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Continued



DE HAVILLAND GYRON JUNIOR jet streamer was shown in standard metal-peroxide installation with a de Havilland Spectra rocket engine in small cloud system above engine intake. Installation closely parallels that of the Saunders-Roe S. R. 55 interceptor. Gyron Junior is rated at 3,000 lb thrust.



DE HAVILLAND GYRON with afterburner developed every other engine at the 22nd International Aeronautical Salon at Le Bourget near Paris. Engine is running at 24,000 lb thrust with afterburning, was developed for a dry rating of 20,000 lb. Length of afterburner suggests an altitude requirement rather than an optimum-length unit. Thirty-segment variable-area exhaust nozzle is fitted to afterburner exit.

Paris Displays Include French SEPR Rocket for Mirage, British Combined Installation

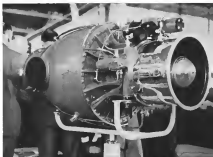


SEPR 641 rocket engine was developed for Dassault Mirage 530 prototype, has been shown experimentally on Mirage IV D2. Thrust of the alcohol-fueled preplant is about 3,100 lb. Life of combustion chamber is now at 25 hr. level.



TURBOMECA ASTAZOU turbojet engine is rated at 120 hp., weighs about 245 lb. without propeller. Rated thrust for take-

off is about 90 lb. Fuel consumption at takeoff is 240 lb/hr., gross consumption is about 210 lb/hr.



TURBOMECA TRANSONIC gas generator has a pressure ratio of 3.5, delivers about 5.5 pounds of air per second. Fuel consumption at rated delivery is about 650 pounds per hour. Generator weight is 375 pounds.

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Wingtip Vortices Menace Light Planes

FL Ricken, Ala.—Tests by the Army Aviation Board have established that turbulent wingtip vortices left in the wake of highspeed aircraft are a major threat to light planes, causing sometimes loss of control and possible structural damage when encountered in flight.

As a result of experiments conducted last winter at Eglin AFB, Fla., (AW Dec. 17, p. 32), the board has recommendations that faster tests and studies be carried out by other aviation agencies.

The board was its own efforts indicate a genuine danger from both the vortices and some shock waves generated by jets flying up to Mach 1.05.

What is needed now, the board said in a report on tests made with a G-17 drone, an F-80 fighter and B-47 jet stream jet bomber, is a comprehensive study covering theory, engineering tests and flight tests to compile significant information. The work is considered beyond the capability of the Army Aviation Board.

With the cooperation of experts from North Aircraft Corp., the board has made several significant observations.

• Duration of wingtip vortices is governed by the turbulence of the atmosphere in which it is generated. Turbulence or wind disperses the vortices quickly, stabilizes the danger which remains in still air.

• Greater vortex disturbances are created when the generating aircraft is flown at low altitudes. This phenomenon would tend to add to the violence created during takeoff and climb, an area in which another light aircraft will not be following the flight path.

• F-80 landing at about 200 ft leaves strong vortices that last as long as 50 sec after the plane has passed a given point. Light aircraft at low speeds would not be creditable in this turbulence.

• No structural damage was suffered in the flight tests, but the board believes light planes flown at low speed in stable air could sustain damage in the vortices created by F-80 or B-47 aircraft.

Ryan Sales Increase, But Cost Cuts Profit

Ryan Aeronautical Co. sales were higher than previous peak during first six months of 1957, but high costs of early part of production cycle for Boeing KC-119 and 707 transport fuselage sections reduced profit \$100,000 below 1956 first half. First half 1957 sales totaled \$30 million, net earnings \$375,014 or \$4.57 a common share.

Paired Bleed Jets Control Flying Atar



Second Flying Atar is manned version of a VTOL test vehicle developed by the French controlled engine firm. Designed C-400 P2, this vehicle is the third step in a multi-step program aimed at developing a family of VTOL aircraft around the subsonic principle developed by Robert Zivkovic. Servicing jacks and other access to the optimum port mounted over the engine as shown (below). Gustav and Flying Atar are completely mobile, can be towed by dolly or attached to truck.

Auguste Morel, Bureau pilot, demonstrated hovering and maneuverability of the vehicle (left and above) at the 22nd International Aeronautical Salon at Le Bourget. Note heavy trusswork structure around the pilot seat. Stickless and control comes from paired bleed jets visible above the engine and forward wheel (left). Engine air forced through the nozzle provides pitch, yaw and roll control and stabilization, can tilt the vehicle in that the thrust vector is confined and down the vehicle in any direction.





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BY THOMPSON

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Air Force Will Switch Drives in B-52

By Robert Gorkman

New York—Strategic Air Command threatens to carry high speed air traffic made B-52 engine will result in replacement of present pneumatic alternator drives with Sandstead hydraulic drives.

Starting with airplane number 109, B-52 bombers will be equipped with 40 kw. Sandstead direct-drive hydraulic alternator drives instead of the 68 kw. General Electric and Thompson pneumatic drives which are now being used to produce the bomber's electrical power. The change will be phased in with the introduction of Pratt & Whitney J57-43 engines to power the B-52. Deliveries of the 1,700 unit order will start in July.

SAC agrees over the safety of the pneumatic system, which had led to one compressor gas blowing the airframe to spin small alternator drive rupture at four points in the fuselage, has been given at the present time to lead the changeover. The first B-52 took was Gulfstream, Calif. last year, brought this change to a head. The crash was and to be the result of an overproducing alternator drive, the fan of which exploded in the vicinity of fuel tanks.

It is possible the last compressor drive is isolated the fuel.

Some USAF sources also claim that up to 30 miles range will be gained from the change. In addition, maintenance and logistics considerations were mentioned.

Not Unanimous

However, USAF sources have indicated to American Wire that there are divided opinions within USAF on this matter. The division here left that the decision against the safety of the pneumatic system has been positive and that the gas in range is now great at best.

Sandstead claims that 1,500 B-52 overall weight (including fuel) will be saved in the change to the direct-drive hydraulic system. Since 31 installed units additional weight is gained for each 1,000 B-52 weight removed, this should amount to 41 reduced miles into cargo or about 30 reduced miles.

The engine blowing incident which led to the choice of a pneumatic system at the beginning of the B-52 project was based on a 2,000 B-52 overall weight saving over a hydraulic system.

Finally the lower loss rating of the Sandstead units must play some part in the decision. The fuel Sandstead 40 kw alternator to be used in the replacement will put out a total of only 160 kw per aircraft as compared to the 240 kw now put out by the four 60 kw alternators. The lower rating of the Sandstead unit is said to be a matter of experience, so by Sandstead drives 60 kw units are now available. So far as the performance of the B-52 is concerned this means that most of the electrical power output has been lost. However, Sandstead says its drives have better overall capacity.

One factor which was lost, which led to the lower power direct-drive hydraulic system is that operational use of the B-52 has indicated that long leading edge drive is not necessary. This would mean that the weight of the fuel in the direct-drive hydraulic system could be reduced from the pneumatic system total.

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SAC View

Apparently SAC has been caught at first by the developmental lead-in of both systems. After being plagued with some of the growing pains of bomber hydraulic systems in the SAC has had to go through a similar experience with pneumatic systems on their B-52s.

The picture has been further complicated by the crash of an experimental B-52 with the new drive at Tulsa, Okla., in March this year. One expert on this crash and that loss of electrical power when the drive mechanical and second under negative G loading caused the accident. The accident occurred while preparing the bomber from 48,000 ft altitude to do a test the fuel tanks which were redesigned when the pneumatic system was removed. Loss of pressure caused the B-52 to exceed Mach number velocity in a dive, causing the aircraft to disintegrate.

Some sources believe in the crash were caused by not taking the correct engine, the nature of the crash has not been confirmed, even though the official report was recently submitted. The Sandstead drive used on this plane was identical to those used on more demanding missions in the F-101 fighter.

Though the alternators are being converted to direct-drive hydraulic system on plane number 109, the pneumatic drive for the non-electrical portion of the aircraft system are being

temporarily retained. For example the flight controls and the APU are worked electrically off the alternators, but the landing gear, bomb bay, spoilers, wing tip protective wheels and gun are worked hydraulically. For those hydraulic systems, pneumatic power is ducted to avoid drive failures and the point of alternator.

Eventually, some time before the presently contemplated 31 wings in 501 B-52s have been built, the bomber will be completely hydraulic with no pneumatic leaks. About the sub-pneumatic system left will be the sub-pneumatic engine inlet drive system.

There will be no retarding of descent down on the ground B-52s up to number 109. For the first time had and soft down will be flying side by side in the same type of bomber, which will mean that more the service will be able to go on observing the way leading edges cannot be introduced from the pneumatic system total.

The practical aspect which is in trouble in the B-52 drive question is effect on engine-outside performance and effect on engine reliability.

Both systems take energy from the B-52 engine on the B-52. Both are done at engine transmission, which translates the engine energy, which is from left to maximum according to flight demands, into constant mechanical speed to maintain the alternator at a steady 400 cps. electrical output.

The difference lies in what form the drive is retained from the propellers.

System Differences

Pneumatic system bleed air from the engine inlet as it leaves the back pressure compressor before it is heated up in the combustor. This 500 7000 psi is ducted to a small air turbine driven alternator. An integral control system in the alternator drive package takes the air coming in the turbine so that whatever the turbine and pressure put out by the engine compressor the alternator is kept within the required 1% of the required 400 cps of the alternator.

In the case of the hydraulic drive the power is subtracted via a shaft geared to the high-pressure spool of the 157 engine. This shaft turns the pump end of a hydraulic pump-pressure variable speed transmission which drives the alternator.

In both cases the turbine on the high pressure spool supplies the energy



Now in Admiral's Electronics Laboratory, initiation test on conducted with a set of 40 tests rated at 20,000 volts. The circuit is driven by a set with a negative or positive drive circuit, not a 40 test test plus voltage.

Admiral research foretells the future of components traveling in outer space

What kind of power will drive man's first vehicle through outer space? It may be an ion propulsion device powered by a nuclear reactor. Some drive is now under investigation for the Air Research and Development Command. Through two programs the intent is to build the human cargo against radiation if a nuclear power source is carried aboard. They also know that efficient design will not permit standard space ship's complex electronic equipment.

Then how will electronic components behave when exposed to nuclear radiation? The tests are being initiated by a continuing study now in progress at Admiral's for the U. S. Air Force. This study provides advance knowledge to engineers charged with designing the space ship's electronic components.

Admiral has equipped a special Electronics Laboratory which includes one of the world's largest, mobile 60 sources of gamma radiation. New instrumentation and techniques have been developed for measuring radiation environments. This project further Admiral's leadership in the field of fundamental and applied nuclear research. Detailed information is available to authorized persons.

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Aero-Gangplank

The new passenger loading facility, called Aero-Gangplank, will be put into operation by United Air Lines at Chicago's O'Hare International Airport in October. It will provide alternative protection for passengers entering or leaving a plane and a direct, one-level link between plane and ground story of the terminal structure. Aero-Gangplank was developed by Lockheed Air Technology, Inc.

to run the aircraft electrical system but as the case of the pneumatic drive, the turbine water runs the turbine and therefore might be used to be utilized twice.

Vickers, Inc., Detroit Mich., a 10-
horse, drive mechanism, controls that a pneumatic drive cuts down the energy left for propulsion more than a direct drive.

Vickers calculates that an bleed drive
can increase fuel consumption and
cost about 10%.

On the other hand, pneumatic drive
advocates agree that as a pod mounted
engine replacement the lower installed
cost of the pneumatic system can save
this under up for the fuel consump-
tion. There is less drag with the pneu-
matic system because the air drive can
be located remotely from the engine
pod.

In addition, they agree that loading
away air ducts to the point of engine
is lighter than carrying heavy elec-
trical power lines to the point of usage
like an engine mounted alternator.
These advantages are claimed to be
most pronounced on the long range
type aircraft of the B-52.

The hydraulic system represents a
third compact, machine, today's best
hydraulic drive is needed in the wing-
root of a dual speed turbojet engine
drive into drag.

The pneumatic system feature of pneu-
matic systems brings up the second
phase of the question—safety. Pneu-
matic systems are sometimes criticized
on this score because they tend to put
equipment originally installed in pod
mounts back into the airframe.

Pneumatic drive, to be competitive
on a B-52 installation, must place tur-
bines operating at high speeds at vari-
ous locations in the fuselage or wing.
These turbines must be fed with 900-
7000 psi air ducted through the engine pod
duct, through the wing, post fuel tanks

and equipment to the turbines. Since
these ducts must be very tight to main-
tain the virtues of low installed weight
for the pneumatic system, they and
their joints are susceptible to stresses
with the shaking of the engine and/or
airframe and inertial loads.

The switch to the direct drive in the
B-52 has been a setback to the pro-
ponents of the pneumatic drive. GE,
for example, has been advancing pneu-
matic drive in the B-52 as an example
of things to come.

The issue of integration of the GE
approach to auxiliary drives (AW
April 15, p. 55) is significant in this
light. The Aerojet Auxiliary Turbine
Division at Azusa, Calif., which makes
the GE pneumatic drive, has absorbed
another GE group, the hydraulic drive
section of Schenck, in order to pro-
vide a unified front to the auxiliary
and engine companies. GE's engine
and divisions has added a drive system
engine group and hopes to be invited
into a weapons system building in the
early phase of the auxiliary system
program. With the shock of the
weapons system responsibility, GE
hopes to make its own auxiliary and
pneumatic drive of two types of en-
gines might be used.

Thompson Products, after removal
from the B-52 program, following the
first crash, has impact of its shock and
control and the USAF observes told
Aerospace Week that the Thompson
product is now more likely later than
the main powerplants. Both GE and
Thompson wanted to make the weaker
links of the pneumatic system fail-safe.

General Electric now has a system
in which the drive alternator can be
automatically paralleled under the
supervision of the Thompson drive.
Speaking before a recent aircraft elec-
trical equipment conference in Dayton,
Ohio, two of GE's engineers described
the new GE 60 hp pneumatic



Getting specific about gravity!

Picking apples benefited Sir Isaac Newton. No
doubt he enjoyed a few of these while devising his
famous gravitational formula. Newton's con-
cern was with what came down, whereas aviation
engineers today are primarily concerned with what
goes up. Even so, the gravitational challenge is the
same.

A jet plane, intercontinental missile—or ac-
tually that missile—usually leaves the design ap-
proach heavy for optimum performance. To be spe-
cific—the specific gravity of the material of con-
struction is too high.

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ture the strength of alloy steel at barely more than
half the weight. What's more, Titanium is un-
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down alternator system, which can be paralleled. This does not use electronic hydraulic control system which permits load distribution within 1/100%—to prevent this system is undergoing flight and qualification testing.

Despite this setback, experts at USAF and private industry do not feel the error of parameters is as big as usual. "In aviation it is the hole seems to be that it can withstand temperatures over 500F that no known hydraulic fluid can stand."

Hydraulic manufacturers at Vickers which is working on hydraulic systems which use silicon, silicon, mineral oils and silicon in special blends to operate in the 500F region, admit that for

1,000F something like a hydrogen or liquid metal fluid will be necessary.

Pressure systems which will stand 1,000F are possible now. CR has recently released details on a small mobile auxiliary power unit composed of two 45 in. cylinders 13 in. long and weighing only 15 lb. This self-contained unit uses a liquid metal perpetually in a small turbine which supplies up to six minutes of shaft power which can then be converted into electrical or hydraulic power at ratings of 14 hp to 54 hp. Though not strictly a pneumatic system in the sense of those on the B-52, nevertheless it substitutes a direction which present pneumatic can take.

units together to delineate the air, and a mass of ducting throughout the aircraft.

Designing, developing and testing the system has required 750,000 engineering man hours to date.

Systems Trainers for 1649As Delivered

North Hollywood, Calif.—Assured automatic system trainers in a class halfway between early operational computers and contemporary static based board trainers have been developed by Motor Electronics Inc.

First order trainers, built under contract with Lockheed-Corson Training School, went to Lockheed specifications and drawings of the Model 1649A Jetstream Starliner and were delivered to TWA World Airlines earlier this year. Three more were due in March for Air France, also via Lockheed's contract.

Trainers are automated for classroom work, consist of varying size panels with components of a system made of variable transparent plastic. Mechanical linkages, driven by pneumatic actuators, electrically or mechanically. Components in some cases are complete units, such as an engine or a turbine of the turbine gear-updown lock system, in others are constructed subunits as in the turbine for the airplane's master hydraulic pump.

Units delivered to TWA included brake, single control brake, landing gear updown lock, an engine/generator, generator, electrical, fuel and cabin pressurization systems, and the hydraulic pump.

Other units the company has fabricated include a mockup of No. 4 engine nacelle area with access to the engine when package which is installed, that the No. 4 area was mounted to show location and routing of ducting, and cut away sections show operation of the various turbines and engine valves.

Also constructed for Lockheed-Corson Training School was a 30-in. photo panel of the plan view of the 1649A air conditioning system, which can be interconnected with other systems. General features of this system. Activation of the main engine controls on the turbine panel can operate compressor, while a system of indicator lights and specific colored, illuminated zones will indicate air flow direction and temperature.

Motor Electronics constructed three shells of cross component procedure trainers. One is being completed for the 1649A airplane, the others are not yet constructed for any specific Constellation customer.

Company has decreased construction

where **DEPENDABILITY** counts most—

CONVAIR F-102A INTERCEPTOR depends upon . . .



<p>Vickers Fine Particle Filter—Removes particles from hydraulic fluid to prevent wear and ensure long life of hydraulic components.</p>	<p>Vickers Thermal Relief Valve—Prevents overheating of hydraulic fluid and ensures long life of hydraulic components.</p>	<p>Vickers 300 psi Hydraulic Pump—Provides high pressure hydraulic fluid for the aircraft's hydraulic system.</p>	<p>Vickers 300 psi Hydraulic Pump—Provides high pressure hydraulic fluid for the aircraft's hydraulic system.</p>	<p>Vickers 300 psi Hydraulic Pump—Provides high pressure hydraulic fluid for the aircraft's hydraulic system.</p>
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The Convaire F-102A off-weather supersonic interceptor depends on Vickers hydraulics for the following important functions:

- Primary and secondary hydraulic systems
- Flow balanced emergency hydraulic system
- Emergency electrical system

The components shown here were selected by Convaire for their outstanding dependability and the additional advantages they offer in superior performance. Their technological advancement keeps pace with aircraft development. The pumps are characterized by minimum heat rejection and highest overall efficiency—all units shown here small size and light weight. For further information, ask nearest office listed below for Bulletin A-3200-D and A-3205.

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OPTIONAL HYDRAULIC SYSTEMS: The Vickers Group, Ltd., Great West Road, London, England

ENGINEERS AND BUILDERS OF OIL FILLED HYDRAULIC EQUIPMENT SINCE 1912



REQUIREMENTS of a new, comprehensive B-58 hydraulic conditioning system which drops air temperatures 1,000F in less than a second are displayed by motor, hydraulic standards.

Versatile System Cools B-58

Tightly-packaged air conditioning system which drops air temperatures 1,000F in less than a second is being installed for Convaire's supersonic B-58 Interceptor by Hamilton Standard, Division of United Aircraft Corporation.

System, described as the most comprehensive ever developed for an aircraft, not only performs the standard jobs of cooling and pressurizing the crew cabin and defrosting the windshield, but also does two essential tasks.

• **Redistributes** air at appropriate temperatures to cool the weapon system's temperature, then, equipment in external pods, including electronic equipment.

• **Cools** air from the windshield with high pressure jets.

Large quantities of hot compressed air from the Hamilton's new General Electric J79 turbojets are supplied to the system. It advances at high rate of cooling with heat exchangers and air cycle refrigeration units. Work done by the system is equivalent to cooling 160 tons of ice a day.

The complex cooling device must produce over 1,100 operating components. Air flow is controlled by more than 50 valves, ranging in size from a tiny unit which controls air flow through a hole 50/100 in. dia. to a big 6 in. dia. valve. Compressing the system air 15 electronic and pneumatic controls



Suppressor Muffles F-102A Engine Noise

Design details of Conquest F-102A are revealed in view of its new sound suppressor buildings where the engine's great jet-flight engine dwells at the shop plant. Engine is which mounted under is applied to wing leading edge is unobscured (above). Other details are speed boxes and airbrakes inside (below, right). Production test cell with one unit that concrete, and buildings are 25 ft. high, 125 ft. long and 45 ft. wide. Cells also can accommodate F-102A. Exhaust lines from Pratt & Whitney J57 engine in ground test installation chamber where direct exhaust ducts blast and then exit 40 ft. high stack over and through a series of wave-shaped metal baffles which absorb sound as blast is deflected upward. Water spray system located on automatic when temperatures reach 400° in transition chamber. Fourth cell is used for engine only. Complex cost \$1 million.



of teams from German and Italian Air Force, in the 1974 negotiations.

Also at the works is construction of a tunnel on Blumstein Standard propeller, for TWA and the Flying Tiger Line. In addition, the company has detailed design and construction of engines on other models of that company's propellers, with full Hamilton Standard competition proposal, plus interest for other manufacturers.

Prices are in the \$2,500 to \$5,000 a range per hour.

Company employs 11 persons, including seven engineers. A 15,000 sq. ft. plant is currently in use, with expansion possible. Large number of test planes formerly were being flown, thanks to Lockheed Aircraft Service, but declined to move to Ontario when LMS services were transferred there, instead they started their own company.

In addition to mechanical work, company presently is designing and building three 3-dimensional impact test for Navy on submarine water distilling system.

\$4.3 Million Contract to American Coleman

American Coleman Co., Littleton, Colo., has been awarded a \$4.3 million government contract to produce 395 M14-140mm tractor for the Air Force. Tractor, powered by a Chrysler gas engine, weighs about 10,500 lb. and can reach speeds of 40 mph. Its use will be to test jet aircraft in excess of 100,000 ft. Price paid includes both 55 of the new tractor for USAF.

WHAT'S NEW

Publications Received:

These booklets, published in the Electronics Tube Series of Philips Technical Library, and available from N. V. Philips Gloeilampenfabrieken, Eindhoven, Holland, are as follows:

Vol. XI, UHF Tubes for Communication and Measuring Equipment — by Members of Philips Electron Tube Division. \$1.50, 20 pp.

Describes in detail the tube range for UHF and SHF waves and deals with some applications of tubes for the near future.

Vol. XII, Tubes for Computing — by members of Philips Electron Tube Division. \$1.50, 52 pp.

Describes the tubes that have been specially designed for other vacuum tube applications in the electronic computer.

Tube Selection Guide—Compiled by Th. J. Kruis. \$1.50, 124 pp.

Aimed at enabling the user to de-

termine quickly which tube is to be selected in a vacuum tube. Illustrated and containing tables printed in Bag left with translations of the text in French, German, and Spanish.

Personal Abilities to Fit the Job—by Bert Hennessey, for Engineering Department, American Mutual Liability Insurance Co., 141 Berkeley Street, Boston 17, Mass. \$2.50, 145 pp.

Written primarily for industrial physicians and engineers, it is an attempt to bring management, medicine and engineering closer together in an effort to adopt better methods for dealing with the medical aspects of job placement and adjustment.

A Technical Dictionary of Rockets and Ammunitions—by Glance Partel (A.I.R.)—Falls for Scientific Publications, Delta State—G.C., Rome, Ind. \$37 pp.

The Associazione Italiana Roma, Roma S. Bernardo, 101, Rome, has prepared the fully revised dictionary, in German, French, Italian, and English.

Electronic Components Handbook—Prepared for Electronic Components Laboratory, Wright Air Development Center, Ed. by Keith Haines and Craig Wicks, Technical Writing Service, McGraw Hill Book Co.—Falls for McGraw Hill Book Co., 350 West

42nd Street, New York 36, N. Y. \$9.90, 724 pp.

Contains data on materials, equipment, and methods in an aid to selecting and applying the best unit for a particular job so that maximum utilization of the end product results.

Aircraft Hydraulic Design—by George Kahan-Poll for Applied Hydraulic Magazine, The Industrial Publishing Corp., 512 E. Ohio St., Cleveland 15, Ohio \$5.00 the copy, \$3.00 for less copies or more.

Deals with hydraulic component and system design for high speed, piston aircraft and missiles.

The Reorganization Guide—Falls for Reorganization and Transition Letter 1450 New York Avenue, N. W., Washington 5, D. C. \$35.00, 282 pp.

Values available to define contact on all of the important information and guidance, both official and unofficial, that has been produced over the past few years, beginning with the passage by Congress of the Reorganization Act of 1951.

Industrial Engineering Handbook—Ed. by J. B. McGraw-Hill for McGraw-Hill Book Co., 120 West 42nd Street, New York 36, N. Y. \$34.50, 1984 pp.

See entry for a complete cover the field.

NEW CALIDYNE 177 SHAKER SYSTEMS



for vibration test
up to 5000 LBS.
force output
up to 400 LBS.
load at 10 g.

The Model 177 is one of a new series of shaker systems designed by CALIDYNE, Inc. for the test of mechanical systems. It is a completely new design, incorporating a new shaker system, a new shaker system, and a new shaker system. It is a completely new design, incorporating a new shaker system, a new shaker system, and a new shaker system. It is a completely new design, incorporating a new shaker system, a new shaker system, and a new shaker system.

Model	Type	Force	Frequency	Load	Price
177-100	Electromagnetic	1000 LBS.	10-100 Hz.	100 LBS.	\$10,000
177-200	Electromagnetic	2000 LBS.	10-100 Hz.	200 LBS.	\$20,000
177-300	Electromagnetic	3000 LBS.	10-100 Hz.	300 LBS.	\$30,000
177-400	Electromagnetic	4000 LBS.	10-100 Hz.	400 LBS.	\$40,000
177-500	Electromagnetic	5000 LBS.	10-100 Hz.	500 LBS.	\$50,000

For more information on the new CALIDYNE 177 Shaker Systems, contact the CALIDYNE Company, 10000 E. 1st Avenue, Denver, Colorado 80231.

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10000 E. 1st Avenue, Denver, Colorado 80231



ARCTIC STUDIES—The only access to this arctic research outpost in Northern Greenland is by helicopter. The Red Rock Camp, Narsarsuaq, established by the U. S. Army's First Engineer Task Force to carry

out ice drill studies, receives food, mail, and passengers by Sikorsky S-55, designated H-19 by the Army. The versatile S-55 is an arctic veteran. It has seen grueling service in Greenland, Northern Canada, and Alaska.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

HELICOPTER HISTORY



FIRST TRANSATLANTIC FLIGHT

In July, 1931, two U. S. Air Force Sikorsky H-19s landed on the coast of Ireland, Scotland, after a record-making 508-mile flight from Boston. This was the longest yet in the land and only helicopter flight across the Atlantic, from Mineview Air Force Base to Wexford, Germany. The pilots were Capt. Vincent H. McGovern and Lt. Col. Harold W. Moore.



ASSAULT EXERCISE—Marines at Camp Pendleton, California, launch a helicopter-borne vertical assault as a feature of a recent major exercise involving 15,000 men. A Marine Corps H-19, an S-55 type, is shown above after landing to assault troops. The Marine Corps also flies larger HH-38 and HH-35 Sikorsky helicopters.



S-55s BOOST OFFSHORE OIL ACTIVITY—New Sikorsky S-55s able to fly 100 miles offshore and return without refueling are speeding up the progress of offshore operations in the Gulf of Mexico. Sikorsky helicopters—both the new twelve-passenger S-55 and its able companion, the S-55—were the acknowledged leaders in the

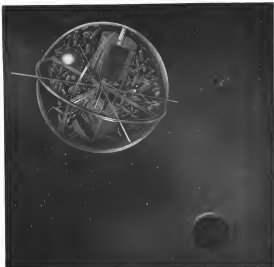
transport helicopter field. In the Gulf of Mexico area they carry over 20,000 men and specialists each month, shuttling on cross-island schedules between shore bases and rigs many miles offshore. Shown above in a delivery flight are two Huey OH and Huey OH Company S-55s.



AERIAL PROSPECTING—Army Service Corporation's Sikorsky S-55 equipped with instruments designed to locate minerals underground started survey activities early this year. On home base and at are an electromagnetic detector, a scribbler, a compass, and a magnetometer. They work automatically as the S-55 closely follows contours over rough terrain.



SIKORSKY AIRCRAFT
BRIDGEPORT, CONNECTICUT
One of the Divisions of United Aircraft Corporation



Putting a voice in the man-made moon

America's first man-made satellite will soon be launched into outer space where, orbiting in its own orbit, it will circle the earth.

Deep inside will be sensitive electronic instruments which will "observe" cosmic activity and "report" findings back to us. Scientists believe that many a mystery of the universe may thus be solved.

Without electrical insulation of exceptional qualities, such as CDF supplies, the equipment inside these man-made moons could never operate.

FOR SPECIFIC INFORMATION on CDF products, see *Wetters, Electronics Buyers' Guide*, and other divisions.

teries. Then send us your grief or your problem, and we'll return free samples and technical literature.

CDF MAKES Dielectric Laminated Plastics • Gels and Polyester-Glass Molded Plastics • Fiberglass Mica Products • Discarded Vulcanized Fibers • Flexible Tapes of Teflon®, Silicone, and Fiberglass • Resin-Impregnated Spiral Tubing • Complete Fabrication Facilities



CONTINENTAL DIAMOND FIBRE

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Final, Formal Report No. 1, and Final Report—Research conducted by E. A. Stone and others at the Ames Research Foundation for the Detroit Arsenal, U. S. Army. Formal Report No. 1, 3, 51-83, 95 pp. (PB 121027) Final Report, 510 1-4 pp. (PB 121038)

Vapor Deposition Coatings: Final Report—by L. M. Schott, H. S. Spind, and J. Wildt, Massachusetts Institute of Technology for the Watertown Arsenal, U. S. Army. 51-75, 64 pp. (PB 121225)

Valuable Changes and Gas Evolution on Heating Polyethylene Chloride—by K. A. Mason and G. A. Connelton, Watertown Arsenal, U. S. Army. 51-50, 15 pp. (PB 121768)

Package and Integrating Printed Circuit Electronic Assemblies—by E. D. Allard, L. G. Brindell, G. W. Eberhart, and M. F. Heston, P. R. McLean, and Co., Inc., for Naval Corps, U. S. Army. Part I, 51-50, 52 pp. (PB 121463) Part II, 51-74, 144 pp. (PB 111714)

Survey of the Literature on Amorphous and Semicrystalline Additions for Laboratory of Elevated Temperatures—by J. W. Cole, Jr., A. Berger, and A. F. Benton, University of Virginia for Wright Air Development Center. 51-50, 533 pp. (PB 121758)

The Southern and Antineoplastic Activity of Some New Polyhalogenated Salts and Salts—by P. D. Lauer, C. M. Murphy, J. G. O'Hara, and R. R. Ravey, Naval Research Laboratory. 51-50, 15 pp. (PB 121568)

Technical Manual on the Machining of Titanium—The Chemistry Co. for Division of Aeronautics. 51-75, 22 pp. (PB 121866)

Magnetic Properties of 6.4 Percent Silicon-Iron Sheet Materials—by J. F. Nathan and W. J. Bevilacqua, Naval Ordnance Laboratory. 51-50, 20 pp. (PB 121545)

The Thermal Decomposition of Organic Nitrites IV: Isopropyl Nitrite, Secobutyl Nitrite, N-methyl N-nitroso, and Ethyl Nitroacetate—by J. B. Levy, Naval Ordnance Laboratory. 51-60, 51 pp. (PB 121178)

Development of Titanium-Boron Alloy for Elevated Temperature Application—by W. I. Garver, L. A. Combs, and D. J. McPherson, Ames Research Foundation of Massachusetts Institute of Technology for Wright Air Development Center. 51-75, 101 pp. (PB 121467)

The Combined Effects of Carbon, Oxygen, Nitrogen and Hydrogen on the Properties of Titanium

Sheet Weldments—by J. J. Rudy, Wright Air Development Center. 51-25, 44 pp. (PB 121491)

Properties of Active Enriched Titanium Alloys—by R. F. Bush and H. Margolis, New York University Research Division for Wright Air Development Center. 51-75, 70 pp. (PB 121461)

Development of High Temperature Stable Densities—by R. J. Casare and T. T. Combs, Federal Research Laboratories, Inc., for Wright Air Development Center. 51-50, 57 pp. (PB 121860)

A Study of the Effects of Clean

liness—by J. G. Thompson, School of Textiles, North Carolina State College for Wright Air Development Center. 51-60, 216 pp. (PB 121679)

Development of Hot-Resistant Treatments for Elastomer-Coated Titanium—by J. M. Auland, Research and Development Laboratories, Corps of Engineers, U. S. Army. 51-75, 51 pp. (PB 121450)

Crimp Buckling of Ultrahigh-Strength Aluminum Alloy Panels—by C. W. King, North American Aviation, Inc., for Wright Air Development Center. 51-75, 70 pp. (PB 121462)

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Input: Two pressures, such as static and total

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Size: 2 1/2" x 2 1/2" x 7"

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NEW GENERAL ELECTRIC laboratory will speed evaluation of complete aircraft electric systems and will allow them

evaluation of electric system development with the aircraft and related systems and components.

GENERAL ELECTRIC ANNOUNCES . . .

New Aviation Lab to Help Speed Development, Qualification of Complete Electric Systems

To provide thorough evaluation of complete electric systems in terms of operational performance under normal operating conditions, and safety under abnormal conditions, General Electric has established a new aircraft electric systems laboratory at Westborough, Virginia. This new lab complements existing component development facilities for generators, constant hydraulic and air turbine constant speed drive equipment, and will help speed completion of current and future programs on these four basic areas:

1. Development of component compatibility
2. Development and evaluation of new systems
3. Qualification testing and reporting on complete systems
4. Co-ordination and assistance in developing components related to the electric systems with customer personnel

Capacity for future systems

To meet the requirements of these programs both now and in the future, the new lab incorporates advanced, high capacity equipment. Currently up to six systems rated to 60 KVA or three rated to 120 KVA can be evaluated.

Three drive stands provide adjustable speed in rated power (250 hp continuous, 300 hp for 5 minutes, and 400 hp for 5 seconds) from 600 to 12,000 rpm in the dual load output shafts. The horsepower varies linearly with rpm of both speeds. A lab system supplies oil at adjustable temperatures up to 400°C to the hydraulic drives and oil-cooled generators mounted on the output shaft.

A heavy flywheel serves as "inertia" for the drives, giving a true representation of the high inertia of jet engines. This flywheel is detached to allow evaluation of constant speed drives under conditions of high acceleration.

How drives help simulate jet engines

Each drive stand is equipped with a General Electric, current-controlled Thyristor® drive. This advanced system can simulate the actual rate of change in engine speed or provide the response needed in component testing. Outstanding features include excellent speed capabilities, high steady state accuracy, and wide speed range. Acceleration and deceleration rates are adjustable or can be preset from 0 to above 1,500 rpm per second. Speed regulation from no load to full load is one percent of base speed. Line voltage variation of plus or minus 10 percent.

*See article on page 24 of General Electric



1200A MONITORING during development and functional checks is facilitated by this control panel. Switches allow continuous adjustment of the load limits up to 120 KVA.



OVERHEAD ALUMINUM roughly help simulate aircraft conditions by duplicating load impedance. Impedance. Control and protection are mounted on top board for easy access.

will cause a change in output speed of less than one percent of base speed.

In addition to high efficiency, the new system provides continuous testing for speed derates. Test running is possible without the addition of a reversing controller. Other features of this all-aluminum control include either constant horsepower or constant torque, and constant voltage, and acceleration limit protection.

Instrumented speed evaluation

The control panel contains instruments used in making system status during development and functional checks as well as providing drive stand control. Switches on the panel control the load banks which are rated 250 KVA at 0.75 power factor per section and are continuously adjustable. A separate panel is used in making the instrument panel exactly as it is prepared for each system.

To simulate aircraft generator failure conditions, aluminum triangles are installed above the control work on board. Aircraft type cables are attached to the same connector on the surface with the rough aging at the skin of the air frame. This method has produced very satisfactory results. Measurements made of the position, nature and area of current concentration of lab installation show close correlation to calculated aircraft installation values.

A high degree of flexibility for interconnecting buses and load banks in the cabinet by load breakers connected to each generator bus. High current capacity circuit breakers allow operation of loads in numerous points in the system.

General Results of Lab Tests

A typical example of demonstration of component compatibility through laboratory testing is the development of the parallel operated, 20 KVA Constant Frequency Power Facility. This system, including statically excited generators, air refrigerators, hydraulic constant speed drives, and protective panels, is made up of all General Electric components, developed and manufactured to operate as an integrated system. The newly developed drive runs a generator with one channel network compensation giving very fast speed responses. The entire system has provided experience in installing the system under high generator speeds, load changes, and fault conditions.

Development of the high phase-to-line voltage sensing principle is another example of progress through laboratory evaluation. Work in current application problems showed a need for a new method of voltage sensing in order to provide a safer system without extra load system losses. To meet this need a General Electric regulator was developed to sense and operate on the basis of the highest of the three-phase voltages for all abnormal system conditions and on the average for all normal system conditions. Laboratory system tests proved this method to be a practical solution to the problem and the

design is now widely accepted and specified for many applications.

Qualification testing and reporting is another important phase of operations at the new lab. Among the systems currently being tested is the statically excited 60 KVA production system for the Lockheed F-105. This relatively small light-weight system simulates the rotating exciter of conventional generators, allowing reduced maintenance costs, reduced line losses, and improved generator cooling and operating efficiency.

Regulator tests conducted on the system included evaluation of voltage regulation, load factors, transient response, protection and transfer functions and coordination of load and system protective devices. Also the lab simulated motor starting and transient tests, and short circuit and open circuit characteristics of all components.

Another important function of the new lab is to provide assistance in evaluating equipment associated with the electric power system during early stages of development. Typical examples of this service are simulation of a substation system which is unique in its power requirements such as large motor loads and regulated inverter systems, and the application of circuit protection in coordination with the overall protective system.

For more information on General Electric aircraft electric systems, components and development capabilities contact your local G.E. Aviation and Defense Industries Sales Representative, General Electric Company, Schenectady 5, N. Y.

Circle 10



OVERHEAD RATED TO 120 KVA can be evaluated singly or in parallel on three drive stands which provide speeds up to 12,000 rpm. Replicate simulate high loads of jet engines.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Three-plant expansion meets growing demand for **SUNDSTRAND DRIVES**

Continued, growing demand for Sundstrand Constant Speed Drives to provide accurate 400-cycle electrical systems for the nation's top military and civilian aircraft has brought about a tremendous expansion in production capacity at three separate geographic locations. In addition, the Western District Office, located in Hawthorne, California, provides western aircraft firms with on-the-spot engineering assistance. More than 20 different Sundstrand drives have been produced, or are being developed—proof of the record for reliability and performance that make Sundstrand first in constant speed drives.

Sundstrand Aviation, Rockford, Illinois

Main plant has been expanded, two additional plants acquired, and a significant addition made to assembly facilities. The Rockford plant is the primary source for Sundstrand Drives.

National Cash Register, Dayton, Ohio

NCR's Defense Products Division is presently producing Sundstrand Drives under a licensing agreement. In up to production, this arrangement provides an additional, experienced, quality source in terms of production run.

Sundstrand-Deere, Denver, Colorado

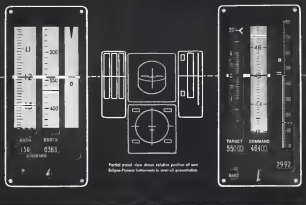
Sundstrand-Deere is set up as a complete second source for constant speed drives along with its own engineering staff. Sundstrand Drives is in full production; it is the largest new plant originally completed about 18 months ago. Its growth, design, and development work on entirely new products is also being carried on.

SUNDSTRAND AVIATION

Division of Sundstrand Machine Tool Company • ROCKFORD, ILLINOIS

Sundstrand Denver, Denver, Colorado • Western District Office Hawthorne, California

CONSTANT SPEED DRIVES • AIRCRAFT ACCESSORIES



Partial panel view shows relative position of new Eclipse-Pioneer instruments in dual-CD presentation.

NEW INSTRUMENTATION SIMPLIFIES JET PILOT'S JOB

Easy-to-read moving-tape command concept is first step in Air Force program to ease burden on pilots

The jet pilot's job is made easier by a new reference line concept in instrument presentation developed jointly by the Flight Control Laboratory, Wright Air Development Center and Eclipse-Pioneer. This new presentation—designed to operate from a Bendix Control Air Data Computer—displays moving tapes in two vertically aligned instruments to tell the pilot at a glance "what is happening" and "what needs to be done". Complex mental computations are eliminated. Actual and desired flight parameters are presented in easy-to-read, graphic (bar, dot, light) information as displayed on moving tapes against a constant, horizontal reference line. Command indications are shown by the black and white bars. Extension of the

moving elements corresponds with the control forces. When the command bars coincide with the horizontal reference line, desired performance is attained.

Suppose for a moment you're a jet pilot. To know what you're doing, you read across the constant horizontal reference line. The instrument at left shows you are flying at Mach 1.2—345 knots indicated.

Your glance switches to the instrument at right. You note an indicated altitude of 55,000 feet. Additionally, the left scale of this instrument shows a 30,000 ft per rate of climb, while the column at far right indicates target altitude—55,000 feet; command altitude—45,400 feet; and ceiling penetration—15,000 feet.

The black and white command bars tell you what needs to be done. The striped bar at the bottom left is the minimum safe Mach marker.

Far-reaching results are forecast for this simplified presentation. By reducing "load in cockpit" time, greater safety is achieved and chances of flight routine errors greatly improved. Training time, too, is reduced.

Bendix is proud to have shared with the U. S. Air Force so important a role in this vital project—a role so closely related to Bendix' successful efforts to be first with the best.

Circle Office, Bendix and Air Products, 6011, Dayton, Ohio, Section "What".
Export Sales & Service: Bendix International, 334 E. 42nd St., New York 17, N.Y.

Eclipse-Pioneer Division

TROY, OH 46060



require hot forming. Transoms will be attached to engine and end nacelle parts both for normal operation and for heated standard conditions.

Contract for the nacelle contractor that Baffert Metals will conduct a research and development program on the nacelle to assist initial forming. This work will be carried out in conjunction with Marquardt production engineers, who will assist the program.

Long Periscope Used On Nuclear Project

General Electric has built what is believed to be the world's longest periscope which has been installed at the Atomic Energy Commission's National Reactor Testing Station to help in the development work on an aircraft nuclear propulsion system.

The 66-ft long aluminum tube, incorporated as remote sensor and host system to allow outside workers to watch performance of a nuclear reactor being tested while working safely behind heavy shielding. Used in conjunction with a smaller, 6-ft periscope (which is still shorter than the length of submarine periscopes) the two optical devices permit observers to watch opposite sides of a reactor while it is in operation, or when it is idly shut off.

Sensing heads at the reactor end of the periscopes are pointed out from the hot reactor into sensing rooms to provide extra assurance against any dangerous radiation that might leak through the long tubes to the observers.

Sensing rooms located around the reactor are under-drive to swing in 180° in any direction desired by the observer.

A small control console at the observer's end is used to move the reactor.

Bendix' superconducting solenoid served energy to approximately 14 tons of the test.

A special motor-driven assembly of three motor assemblies keeps the reactor cool to the reactor.

A third periscope, also being developed by GE, is equipped with a liquid camera and is designed for high image features.

With it, hot cell technicians can perform tests monthly and quarterly, also which compare in deflection to flexing a nacelle by remote control while using a mirror instead of direct vision.

GE is engaged in work on the government's aircraft nuclear propulsion development program at its Remond, Ohio, plant and at the AEC's Idaho Falls test site under contracts with the AEC and the Air Force.

In air-fuel sections, strength, accuracy and smoothness are of primary importance. These characteristics, plus a minimum of machining, are offered by the Atomic Process turbine fin casting. The alloy, A-336, Turbinefin of 0.10" in thickness and 0.005" T & R, on fixtures are held in production. Surface finish, as cast, is better than 125 RMS. Test bars machined from heavy hub section have minimum ultimate strength of 36,000 psi and elongation of 11%.

Morris Bean & Company specializes in casting parts for wave guide, fluid flow, and aircraft applications to demanding standards and in volume production.

If your designs call for high performance aluminum parts, get acquainted with Morris Bean castings. Send us a part print for recommendations. Technical literature on request. Morris Bean & Company, Yellow Springs 4, Ohio.

a cast rocket fin?





"Bernie" Fenwick, outside Friendship International Airport's Terminal Building. Directly behind him is a Constellation operated by Eastern Airlines, one of Pan-Maryland's prime customers.

"There's no ceiling on success when you fly with Shell!"

says G. B. Fenwick, Jr., President of Pan-Maryland Airways. P-M boosted its gullonage fiftyfold in six years as a Shell Aviation Dealer at Friendship International Airport, Baltimore

It's no wonder Bernie Fenwick is happy Pan-Maryland teamed up with Shell in April 1961. At that time, one truck was more than enough to handle their business. Three months later, thanks to Shell's help, they began making in-plane deliveries to the airlines.

Today, Pan-Maryland has 13 trucks busy fueling and servicing the airlines, private airplanes, jet fighters of the National Guard, police department aircraft, helicopters, military

and government-owned aircraft and dozens of corporate aircraft.

"We've got an extremely diversified operation here," says Bernie. "Pan-Maryland handles everything from Cubs to F4D Navy jets—from Mites to B-52's."

"Consequently, we handle the complete line of Shell Aviation Fuels, including Shell Turbine Fuels for jet planes and commercial turboprop airplanes.

"Shell also provides us with a full line of AeroShell lubricants, fluids and greases to fit our customers' needs. What's more, we get up-to-date technical advice from our Shell representative who's always at our service."

When Bernie talks about the services Pan-Maryland gives its customers, he emphasizes that delays are almost nonexistent. All pilots have schedules to meet and what they want most of all is fast, efficient, on-schedule service.

A "Customer's Service Report" is mailed to every flier who stops at the field. It invites comments and criticism of service, workmanship and courtesy. Replies like "Best service I've ever gotten—anywhere," "Excellent in every way," "Keep up the good work," are received every week from all over the country.

Bernie points out that their CAA Certified Repair Station is going to be finer than ever. A big new hangar will be completed soon and he plans a Class 4 shop there, with service crews qualified to work on every type of plane.

Other plans for the future include branching out into airline ramp service, setting up an aircraft sales department, building more hangars and boosting gullonage still further.

"After all," says Bernie Fenwick, "the sky's the limit with Shell."

It pays to be a Shell Aviation Dealer
—and the Shell office nearest you will be glad to show you why



Private planes get first-class treatment, too. Every civilian pilot who uses the field receives a "Customer's Service Report" which requests suggestions for improving service.



The Boeing 707 jet transport is fueled by Pan-Maryland with Shell fuel at Friendship International Airport after its recent record 5-hour, 46-minute transcontinental flight.



Bernie discusses plans for future expansion with Col. J. Colonna, Airport Director.

Desert Patrol

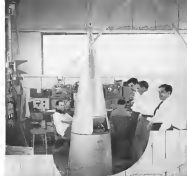
De Havilland Otters, manned
by R.C.A.F. pilots, play a
vital role in U.N.E.F. operations
in the Middle East



Designed and built by

THE DE HAVILLAND AIRCRAFT OF CANADA LIMITED
POSTAL STATION "L" TORONTO ONTARIO

Western Sales and Service: (Windsor Airport), Edmonton, Alta. • Pacific Coast Sales and Service: International Airport (Vancouver), B.C.



Vanguard Takes Shape

Early satellite Vanguard sounding vehicle at globe tested in tower at Martin Co., Baltimore. View (top) at 800 level (above). View from ground (right) shows part of the five levels. First and second stages join at third level (below). Latest operations tests on the satellite vehicle.

* LENGTHS

First Stage	44 ft
Second Stage	31 ft
Third Stage	7 ft
Overall	79 ft

DIAMETERS

First Stage	45 in
Second Stage	50 in

NOVELTIES:

First Stage	Dipole Oxygen and Kerosene
Second Stage	White Fueling Nitric Acid and Element
Third Stage	Solid Propellant

WEIGHTS

First Stage (Overall Weight)	51,000 lb
Second Stage (Stage Weight)	7,500 lb

** VELOCITIES

First Stage Burnout	2,700 mph
Second-Stage Burnout	5,500 mph
Third-Stage Burnout	10,800 mph

RANGES

At First Stage Impact	270 mi
At Second-Stage Impact	1,500 mi

ALTITUDES

At First Stage Burnout	28 mi
At Second-Stage Burnout	138 mi
At Second-Stage Apogee	200 mi
At Third-Stage Burnout	500 mi

STAGED FLIGHT TIME

Vertical Ascent	70 sec
At Second-Stage Burnout	230 sec
At Third-Stage Burnout	400 sec

GUIDANCE SYSTEM COMPONENTS

First Stage	Proton Programmer
Second Stage	Counting Time Computer With Integrating Linear Accelerometer
Third Stage	Three-Axis Gyro Reference System
Fourth Stage	Magnetic Amplifier Amplifier
Fifth Stage	Program Timer

SEPARATION TECHNIQUES

First Second-Stage Separation	See separation bolts
Second Third-Stage Separation	Radial pressure from valve opens third stage retro rocket drive doors
Third-Stage Separation	second stage at third stage drive, delay from igniter third stage

REMARKS:

- * Stage lengths are not cumulative since portions of stage lie within each other.
- ** Includes velocity gained due to earth's rotation.





J79s on Final Assembly Line

Final assembly horizontal line at General Electric's Erie-Rochester plant shows J79 turbojet engines on stands. USAF has awarded series of new contracts for development of the high thrust-to-weight engines (AV May 27, p. 29) the latest this month totaling \$4 million. In foreground (left to right) are Corbair Neumann, general manager, jet engine department, E. R. Montgomery, general manager, piston engine department, and G. E. Anderson, manager, assembly and open parts section, production engine department.

AMC Contracts

Weight-Precision AFB, Ohio—Full licensing of a lot of mechanical contracts for \$15,000 and over is released by the Air Materiel Command.

North American Aviation, Inc., San Antonio, will design two engines in 1960 for the USAF. The engines will be used for the USAF's new aircraft, which will be used to perform a wide range of missions in the future. The engines will be used for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Alameda Proving Ground, Calif.—The USAF has awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Public Relations Inc., 22 W. 50th St., N. Y. C., has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Mass. Institute of Technology, Cambridge, Mass., has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

The Engine Research Products Co., 800 Vermont Ave., Boston, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Standard Oil Products Co. Inc., 1000 Lexington Ave., New York, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

The United Gas & Oil Co., 700 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Engelhard-Alloy Steel Corp., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

The Goodrich Tire & Rubber Co. Inc., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

United Aircraft Corp., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

The Ford Corp., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

Verdeux Aircraft Corp., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

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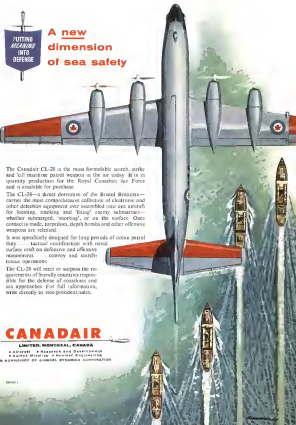
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**PUTTING
MEASURES
INTO
DEFENSE**

**A new
dimension
of sea safety**

The Canadian CL-28 is the most formidable search, strike and full maritime patrol weapon in the air today. It is in quantity production for the Royal Canadian Air Force and is available for purchase.

The CL-28—a direct derivative of the Bristol Britannia—carries the most comprehensive collection of electronic and other detection equipment ever assembled into one aircraft for locating, tracking and "snuffing" enemy submarines—whether submerged, "surfing", or on the surface. Once contacts are made, torpedoes, depth bombs and other offensive weapons are released.

It was specifically designed for long periods of ocean patrol duty—actual coordination with naval surface craft on defensive and offensive reconnaissance—convoy and search-rescue operations.

The CL-28 will meet or surpass the requirements of friendly countries responsible for the defense of coasts and sea approaches. For full information, write directly to your president/leader.

CAA Contracts

Washington—Following is a list of contracts as released by the Civil Aeronautics Administration.

Consolidated North Electric Corp., 1000 N. W. Washington St., Dallas, has been awarded a contract for the development of a new engine for the USAF's new aircraft, which will be used to perform a wide range of missions in the future.

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CANADIAN

LIMITED, MONTREAL, CANADA

• Montreal • Research and Development
• Sales Offices • Montreal • England/USA
• a subsidiary of Canadian Overseas Corporation

SPECIAL

Aerodynamist — Four have ability to set up and solve problems to control performance, stability and control with a minimum of experience. Four years experience required. Salary wage experience desired, but not essential. All regular individuals. Write to Mr. M. Tyson, Administrative Engineer.

Change your $\phi + P4$ a S with xH .

We have the solution . . . get it now!

KAMAN

THE KAMAN AIRCRAFT CORPORATION
71 Old Windsor Road
Bloomfield, Conn.

85

Send me solution to your sales and information on Kaman.
My engineering problem is _____

Name _____

Address _____

City _____ State _____



"Engineers—we've achieved **SUSTAINED**
supersonic flight...!"

"As Chief Test Pilot at Convair-Fort Worth, I've flown initial and subsequent tests on several of the outstanding aircraft created by Convair's design and engineering teams. Surpassing all, however, is their latest and most significant achievement, the Convair B-58 . . . built for the U. S. Air Force."

"The Convair B-58 is a completely integrated aerial weapon system. As America's first supersonic bomber, the B-58 has the capacity for sustained supersonic flight which represents a performance breakthrough vital to American military aviation. Such an accomplishment reflects the ability of Convair engineers and scientists to think far beyond conventional ideas of design and performance."

If your ambitions and qualifications fit into the progressive and stimulating picture at Convair-Fort Worth, you're invited to investigate. Many of America's top engineers and scientists, now an integral part of our team, have discovered at first hand what we mean when we say "Your future is NOW" at Convair-Fort Worth."

In Fort Worth, you'll enjoy a well-ventilated, low cost-of-living and adequate housing in all price ranges. There's no state sales or income tax—no commuting problem.

W. A. FERGUSON, Chief Test Pilot at Convair-Fort Worth, B-58. In top right corner, Convair B-58. In bottom right corner, Convair B-58 in flight.

CONVAIR
FORT WORTH
FORT WORTH • TEXAS

Write today in confidence to: Mr. H. A. Blount, Engineering Personnel

CONVAIR IS A DIVISION OF GENERAL DYNAMICS CORPORATION

SUD-AVIATION CARAVELLE

ECONOMY • COMFORT • RELIABILITY • SPEED



ROLLS-ROYCE
AVON
TURBO JETS

ROLLS-ROYCE LIMITED, ENGLAND, SCOTLAND, CANADA, AUSTRALIA

BUSINESS FLYING



Viscount and by Brazilian president custom military fuel tank on underside of wing suffered of Rolls-Royce Dart engines.

Viscount Plays Dual Role in Brazil

Rio de Janeiro—High rate of attendance is being achieved by the executive Viscount and by Brazilian President Juscelino Kubitschek, who is a confirmed user of aircraft for overseeing his huge country.

In addition to being a high-speed transport for the president and other top government officials, the Viscount also is serving as a means of delivering out Brazilian air force flight and ground crew to various transport operations.

Providing these tangible assets the turboprop transport also serves as an important public relations communication piece and a crowd collector wherever the president goes.

President Kubitschek has been averaging at least one flight monthly in his Viscount since he received it only this year. There are periods he will use it three and four times during a busy week.

Because of Brazil's size and lack of adequate surface transportation, the country's politicians have to rely almost entirely on the traditional train in stamping the nation. Also the president is sponsoring establishment of a new capital, located in the interior, called Brasilia, where he has had a special 1,400-hr special train in addition to that he can make frequent weekend trips publicizing the new relocation plan.

Operation cost of the Viscount is reported to be slightly over that of a Cessna 440, but less than for a Cessna 440.

The six force technicians who fly and maintain the executive Viscount,

say that it has an average cruising speed of 310 mph and it can make flights to various airports in Brazil or South America with only one stop. Perhaps one of its main uses is that it can take the president and a party of 24 in and out of small fields such as Santa Maria, Rio Grande do Sul, which has a 4,200-ft runway, where a Douglas DC-8 or Lockheed Constellation probably could not operate safely.

Whenever the president wants to reach a spot in the interior where the field is too small for the Viscount, he

flies to the nearest large enough airport and continues his journey in an air force Douglas C-124. He has found that by using the Viscount as a "work horse" and switching to smaller aircraft when needed, he gets in two or three times as much traveling as he previously did when using these planes. President Kubitschek recently took delivery on a new Beech Super 35 executive twin, suited for short trips and small-field operations.

The Beech Super 35 was one of five purchased by the Ministry of



CUSTOM INTERIOR has executive suite (center in photo) with private lavatories, rest room and bedrooms, luxury separated from main cabin which has 24 passenger seats.



Surviving Impact is an Eimac Ceramic Tube Extra

Aerospace electronics demands extras from vacuum tubes. Among them is the ability to withstand heavy impact without impairing electrical characteristics. The photograph dramatically shows what happens to a 250 watt glass envelope tube and an Eimac 350 watt ceramic tube when both are dropped from a height of seven feet. The ceramic tube "took it."

Other advantages of Eimac ceramic tubes are resistance to damage by vibration and temperature; smaller size without sacrificing power; ability to undergo operation processing techniques that lead to tube reliability and longevity.

The small Eimac ceramic 4CK3054, shown above, will withstand 300 shocks of 15 millisecond duration. It will operate in airborne or ground station service at full ratings up to 5000m.

In its new line of ceramic tubes, Eimac has the answer for the aerospace engineer who needs a tube that will deliver full output under extreme environments.

For further information, consult our Application Engineering Department.

EITEL-McCULLOUGH, INC.
SANTA MONICA, CALIFORNIA

Eimac First with Ceramic Tubes that can take it



ACCORDING TO BUSINESS TO BUSINESS

	FW	AM	SSB		FW	AM	SSB
B-C Plate Ratings	2000	1000	2000	Plate Dissipation watts	260	260	260
B-C Screen Ratings	300	300	400	Screen Dissipation watts	12	12	12
B-C Grid Voltage	-250	-250	—	Grid Dissipation, watts	2	2	2
B-C Plate Regulators	250	200	250				



BUCKETS and BLADES for AGT

We design and build:

- Forge Dies
- Drawing Dies
- Investment Molds

We machine to ✓

- Forgings
- Solid Stock
- Investment Castings
- Centrifugal Compressor Wheels



*For specifications

Therm-electric
METERS CO., INC.

Ithaca, New York



Helicopter Rescues Deer

Cost Guard Service 5:51 began evacuation of first of 508 730 deer strung on perimeter of land in Montpelier River delta. Only one deer could be killed at a time.

Approximate for cost in high craters and military aircraft.

Brown Air Force now has 26 operational fields strategically located around the country, capable of taking the president's Viscount. Of these, however, only 10 are equipped to handle Viscounts. From Rio, the Viscount has sufficient range to touch every major city in the country without refueling, with the exception of Mexico on the Atlantic. Fuel capacity is sufficient to reach Mexico, but not the nearest oil tanks, so the Viscount must stop at Recife or Guaya, Mato Grosso.

Largest nonstop flight from Rio is to Belém at the Amazon's mouth, where there are two good alternate fields, a distance of 1,500 mi. The Viscount recently crossed this nonstop in five hours.

Hot-Weather Operation

Pilots say that the fields present a problem in that they must be clear of stones and other foreign objects. At Belém, for example, a stone struck a propeller on takeoff, necessitating a propeller change. An airport paving program starts this month and at least 10 fields a year for the next four years should be provided further expanding use of the Viscount.

Another problem, according to pilots, is hot weather operation. Belém's hot season sometimes lasts nine months. Pilots say that they can't get the Viscount over 10,000 ft during hot months and must get it over 22,000 ft even in "cool" weather periods. They say that during the hot trip from Rio

land that coastal at 74,000 ft.

The president may be prone for one incident, night flying must be done to make reliable daylight hours traveling.

It was thought that providing for the president's Viscount was a major problem, but this was not developed. Medel and Ross supply the Air Force with lessons for the jets and then for the fuel dumps and tanks at 10 fields, will soon set up facilities at those more or other exist. The way, however, Air Force advises the companies to be in advance to have fuel and oil supplies ready at distances so that trucks and buses that have been jumping gasoline can be skidded and ready to service before long. The operation is providing the fuel companies with fueling know-how and equipped stations for the time when VASP admits its first Viscount late this year at Rio de Janeiro.

Described originally for Belém, a Norwegian shipping firm, the Viscount was picked up by the Brazilian government when the customer dropped out. Considerable work was done on the delivery to give the president a private suite with bedrooms, conference room and private kitchen. About of the presidential suite in the passenger area consisting 24 seats. Flight deck was specially modified to provide room for a radio operator. A crew of five carried two pilots, a flight engineer, a radio operator and a steward.

The air force has a second executive Viscount on order, which will be fitted with a belly fuel tank, similar to U. S. Stet's airplane, to provide additional range.

Doman Has Orders For 3 More LZ-5s

Newark-Doman Helicopters, Inc., announced in LZ-5 has announced an order for three more from Pittsburgh Aircraft, Inc. Salesman to 15 the total of approximately 125 to sold in lot.

Flight demonstration at Newark Air port marked the opening of a sales campaign. LZ-5, which carries 5,100 lb and seats up to seven passengers, lists for \$125,000 and is slated for nine months delivery.

Doman believes the commercial heli-

copter market is growing steadily and expects interest in high-capacity helicopters during the next year, double that volume the following year. First LZ-5 customer was Heliconair de Colombia, Bogotá, with an order for 10. Doman also expects development of the commercial-capable market depends on availability of a suitable small turbine engine for single or twin engine configurations of a basic aircraft.

LZ-5 is powered by a Lycoming SO-580A-B engine developing 490 hp at takeoff, 350 hp at its continuous rating at 1,000 rpm.

Dutch Firm Completes New Spray/Dust Plane

Light agricultural airplane is being tested for flight tests by Hollandsche, The Netherlands. Prototype will be powered by a 135-hp Lycoming, but 150-hp and 200-hp engine installations may be made later, according to the company.

It estimates that production models will cost approximately \$4,800.

Twelve-seat prototype will be fitted with two modernizing fibreglass tanks of 40 U. S. gal capacity each for spare chemicals. A chemical dust hopper can be fitted in place of the rear seat. Airframe is built up of welded steel tubing. Wings are of space fabric covered. Calculated performance is: climb.

Takeoff and landing within 170 ft; full load stall speed 40 mph; optimum speed, 56 mph; initial rate of climb, 1,100 ft/min. Cruise speed is estimated in 90 mph. The high-wing airplane will have a span of approximately 49 ft.

PRIVATE LINES

Clenna NT-37 Ser. 50-710, one of three hand built prototypes of side-by-side USAF jet trainer, has been delivered to Air Force Museum, Dayton, Ohio.

Aircraft Transport, Inc., is now Santa Ana, Calif., charter operation using a Bell 47-G2 in industrial, forestry and geological survey assignments.

First approval for an air taxi operator to establish office in a military post has been granted Skyway Air Travel at Ft. Chaffee, Ark., by Military Traffic Management Agency, Washington, D. C. Military personnel on leave or with discharge can now get private charter air service for direct flights to off-airway destinations.

State of Washington officials are studying a proposal to buy at least one airplane for the state motor pool as a result of increased aviation by American Travelers, school building facilities decrease. Transportation reported he would be offered \$25,235 in six months for testing and flying on airplane on official business as pilot of other forms of transport be formerly used.

Spare parts for T-28C Models BCF-1D, D and 19 biplane-covered or built may be produced by Universal Aircraft Industries (Clematis), Denver, Colo., in a result of negotiations with T-28C-1, Inc., Conway, Pa. Universal will also supply the factory and T-28C-1.



Solar Advanced Technology

Taming hard-to-work titanium with "purge chamber" welding

ARCHITECT AND MATERIALS DEMANDS call for more and more titanium. The superior strength-to-weight ratio of this new metal serves vital purposes in aerospace, engine and missile components. Solar is leading the way in taming this hard-to-work metal.

The plastic purge chamber, shown above, is a Solar development to facilitate working of titanium in an atmosphere which protects the weld from elements in the air. It is one of many advanced fabricating techniques perfected in Solar laboratories to help

achieve titanium's promise. As a result, Solar today is among the largest users of titanium for aviation purposes, and is constantly testing and working with new techniques requiring experience and expert ability.


This is one example of Solar advanced technology—a combination of skills, facilities and forward-looking pioneering. Perhaps Solar can bring a fresh viewpoint to your difficult metal-working problems. Write to Department D-45, Solar Aircraft Company, San Diego 12, California.



New "Solar Advanced Technology" facilities brochure is of value to you... Write for it: SOLIDWORK, DEVELOPMENT AND MANUFACTURING • GAS TURBINES • AIRFRAME AND MISSILE COMPONENTS • GEARBOX • CONTROLS • EXHAUSTS • NOISE, VIBRATION

Here's Why **MOHAWK Airlines Inc.**

CHOOSES AIRWORK ENGINES



"When we acquired our fleet of Comets, we found their engines had been overhauled by 7 different shops: in as many different standards. A overhaul and revised line like Mohawk demands the best advance engine maintenance procedures to meet our safety and performance standards. We found the procedures we wanted were available in the Aircraft Overhaul Shop."

E. A. "BAP" BARTLETT
Supt. of Maintenance

GLENN IRWIN
Purchasing



BRANCHES IN
NEWARK
MIAMI
CLEVELAND

Airwork
CORPORATION

Mobile, Ala. Jones



QUARTER-BILLION
DOLLAR BACKLOG
with 48%
COMMERCIAL WORK

A WHALE OF
AN OPPORTUNITY
FOR DESIGN ENGINEERS

The peaceful environment, the dynamic growth, the pleasant weather, the vibrant spirit of "togetherness" and enthusiasm in Rohr provides challenge and chance for quick advancement found in few places.

Salary and security among the best! Southern California living ideal year-round!

Design engineers with ability are invited to inquire now. We'll respond at once and arrange personal interview at mutual convenience. Send resume to J. L. Heller, Rohr Aircraft Corporation, Chula Vista, California, Department 42.

WORLD'S LARGEST PRODUCER OF

FLIGHT TO HYDRAULIC POWER PACKAGES AND AIRPLANS



CHULA VISTA AND UNIVERSO, CALIFORNIA

Corp. for supply work in connection with aerial exploration surveys in North Country section of Alaska. Firm also operates a Lockheed 32 and a Hiller 134C.

Special 325-page sales booklet for executive and market pilots detailing principles, operation and application of Sperry Integrated Instrument System is available from Sperry Gyroscope Co., Division of Sperry Rand Corp., Great Neck, N. Y.

New charter plane service, Island Express Airways, Inc., has been formed at San Rafael, Idaho, using four four-engine-type planes acquired from a group of Northwest lumber firms.

U.S. helicopters exports in first quarter of 1957 nearly doubled over same period last year, total of 64 units valued at \$16,915,510 compared to 31 shipped in 1956 valued at \$1,770,550. March 1957 shipments of 31 helicopters nearly equaled all of 1956 first quarter.

Bombardier Canadian Car Co., Ltd., Montreal, to build its Model 35 Jet Mentor trainer. Jet Mentor was sent to RCAF station at Toronto, Ont., for a week of evaluation, was also scheduled for demonstration at the RCAF station at Ottawa.

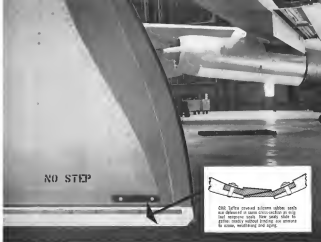
Santa Pacific Airlines Corp., a new charter line using Twin Bonanza and Bonanza aircraft based at San Jose, Calif. Daily flights are operated to Reno and Lake Tahoe and weekend service to Las Vegas, Mexico City and La Paz, Mexico.

Bank of Montreal will take delivery of a turboprop-powered Fawcett P-27 Euroshipper executive transport in September 1958.

Chicago Skyways, Inc., Chicago, retained Design Dynamics, Inc., to develop and design personalized executive and personal plane interiors for its customers.

United Transports, Inc., Glendale, Calif., will take delivery of a Howard Super Ventura executive transport in October, Koltz Agency, Inc., New York, recently acquired its Super Ventura Bonanza rider and Acrojet-General Jet was among the equipment on the list.

Delivery of Bell 47D executive helicopter to Arthur Young Davis, Miami, Fla., was made from Bell's Miami, Fla., plant in 12 hr 7 min, average speed for the 1,275-mi flight being over 100 mph. Four-place 47D replaces the former three-place Doss 47C-1.



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CHR adapts new seal development to B-77 bomb bay doors.

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visible protection against oxidation from nuclear weapons.

CHR Teflon covered seals are also being used on other planes where low friction, sliding action, shock resistance and resistance to ozone and synthetic lubricants is required.

Our experience in helping engineers with all types of neoprene and engine seals utilizing all forms of silicone rubber reinforced with fibers, Teflon and metals can be put to work for you. We select your neoprene for specific applications. Call or write. CHR field representatives are available for direct contact.



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Berets for USAF Geord

Uniforms for special protective ground for Strategic Air Command's new underground control center at Omaha, Neb., include blue felt berets, chrome plated belt buckles and knee knickerdillo (flared pants) in black over dress khaki. Wait, making service out of the new uniforms, is only one in USAF's on equipped.

men for Canadian Pacific Airlines DC-6 flights at Cold Bay are 400 ft. and are such for straight in approach at night and 100 ft. and 14 sec for landing approach.

Capt. Brown, who occupied the left seat at the time of the accident had been qualified as a captain on Canadian Pacific Airlines domestic lines for over 30 years prior to assignment to the Overseas Division. He had made a number of round trips over the Vancouver-Hong Kong route on being based out of Cold Bay, and the subject flight was in preparation for his checkout as captain on the route. His first flight here was 12,750 hours, which included 465 hours in DC-6 equipment. Company records showed that Capt. Brown was qualified according to company policy and Canadian regulations as a captain in the DC-6B, at the time of the accident he was in the process of making over the Vancouver-Hong Kong route. Company policy required that line pilots attend flights under the supervision of a captain already qualified. This was being done under Capt. Tread on the field.

The another landing occurred in the case of Flight 107 at Vancouver scheduled a descent for Cold Bay the second 1200 on 1200, Aug. 23, 1956, as follows: Ceiling 500 ft.; present visibility 5 mi light drizzle and fog, wind was 18, after 3360 ceiling 1,200 ft., present visibility 7 mi, wind southeast 12.

The actual weather on route appears to have been quite close to that forecast at the landing, with the exception of the lower ceiling at Cold Bay. The 2874 Cold Bay report was indefinite ceiling, 500 ft. in the observed, visibility 14 mi, light drizzle fog, temperature 7°, dewpoint 46°, wind was southwest 21, and barometer setting 29.89. This report was received in the flight before the arrival at Cold Bay.

The findings for the approach to Cold Bay was through an instrument and the ceiling and visibility at that time were reported as 500 ft. and 14 mi. The weather was reported with 39 ft., and barometer setting

was later predicted light to moderate to below at altitudes below 2,000 ft.

It is probable that the correction of the plot during the approach was to land on runway 14, a straight in landing from the observed windward of the major stream. The breakout after descending through the

clouds over here has too close to mid high and then factors together with 10 times, ground speed due to a gusting tailwind, was here caused the captain to decide to go around.

Whether the flight intended to turn and climb to 2,700 ft. on the north leg of the Cold Bay report, is the instrument approach procedure according to the report, the 500 feet ceiling and land on runway was not a full factor. However the company dispatcher, who observed the accident and was in radio contact with it, thought the decision was for the latter course as he was about to question the flight whether it wanted the other runway (28 ft.) lighted when the crash occurred.

Considering that very little altitude was passed after the approach at ground it is probable that a engine approach had been decided upon when the 500 feet there was not 14 mi. much.

Since the wing tips during the landing approach would be extended 29 deg., and since they were located in the fully increased position, it is believed that they were not moved down before impact. If this is correct wing tips at that time would explain the feeling of "soft" experienced by the all-day flight crew member.

It should be noted that the upward of the vertical of the base the flap was in fact was approximately 130 to 140 ft. This is reported in actual fact. Around the 100 ft. the flap was in fact was in the down wind leg of an approach to a runway on the runway to 10 ft. at an impact of approximately 140 ft. with wing tips in

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tested 29 deg. Since the aircraft occurred in a close configuration (gear and flaps up) immediately prior to the accident, with a heading of approximately 20 in, it would be reasonable to assume that the speed of the aircraft increased during the fuel dump. In addition, when the aircraft moved over runway 14 it was in landing configuration. Since only slightly below 1000 ft error power was applied at this time, and as the distance to the point of impact was approximately one mile, it is unlikely that the speed of the aircraft would have been much greater than 140 kt when the fuel was exhausted.

It is evident that the aircraft must have been well descending as a light left turn and while all four engines were not operating at the prescribed power settings necessary to execute a missed approach procedure.

FINDINGS

On the basis of all available evidence, the Board finds that:

1. The cause, the accident, and the crew were causally connected by the Department of Transport of Canada.
2. The gear load at the aircraft was within allowable limits.
3. The timing and visibility were at or near the carrier's minimum for Cold Bay.
4. There was an unusual failure in functioning of the aircraft on its own power, so far as it could be determined, prior to ground impact.
5. A questioning interval of 20 kt was present for a heading on runway 14.

6. A timing approach was initiated during which the wing tips were prematurely fully extended.
7. The flap extension, without a corresponding increase in power, or change in attitude, or combination thereof, caused a substantial loss of lift resulting in a loss of altitude.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the full extension of the wing flaps at low altitude during a timing approach without necessary control action being taken by the crew.

By the Civil Aeronautics Board:

1st JAMES R. DENTON
1st CAROL GORDON
1st HENRY D. DUBOIS
1st G. J. JENNINGS
1st LEO J. HENSON

SUPPLEMENTAL DATA

The Civil Aeronautics Board's Accident Act, which was passed on Aug. 29, 1958, is designed to provide for the investigation of accidents with the provision of section 702 (1) (2) of the Civil Aeronautics Act of 1958 is amended. A public hearing was held by the Board and was held in Seattle, Wash. on Nov. 26, 1958.

AIR CARRIER

Canadian Pacific Airlines, Ltd. is incorporated in the Dominion of Canada and maintains its principal place of business at Vancouver, B. C., Canada.

The company operates an Air Transport (ATC) license and an operating certificate issued by the Canadian Department of Transport.

It also operates a Foreign Civil Aircraft Flight Permit issued by the United States Government authorizing the carriage of persons, property, and mail over the route described in this report.

FLIGHT PERSONNEL

Capt. Thornton A. Tread, age 35, was employed as a pilot by Canadian Pacific Airlines on July 1, 1947. He held airline transport license No. 45, issued Mar. 10, 1953. Capt. Tread had, according to company records, total pilot time of 9,921 hours, of which 2,465 were assigned in DC-46 or DC-48.

His last instrument and air route check was given May 15, 1956 and May 22, 1956 respectively. His last physical examination was taken on April 17, 1956. He had had 78-46 flight hours in the 30 days preceding the subject flight.

Cecil Philip D. Brown, age 37, was employed as a pilot by Canadian Pacific Airlines on May 1, 1947. He held airline transport license No. 475, issued May 20, 1953. He was employed by the Department of Transport of Canada. This license was endorsed by the Department of Transport for DC-48 aircraft. Capt. Brown had, according to company records, total pilot time of 12,781 hours, of which 465 were assigned in DC-46 or DC-48.

His last instrument and air route check was given May 17, 1956 and June 27, 1956 respectively. His last physical examination was taken on July 23, 1956. He had had 78-46 flight hours in the 30 days preceding the subject flight.

First Officer Robert Lane, age 28, was employed as a pilot by Canadian Pacific Airlines on Feb. 22, 1955. He held airline transport license No. 716, issued Aug. 5, 1956. He had, according to company records, total pilot time of 3,473 hours, of which 112 were in DC-48 aircraft. He last air route and instrument check was given Nov. 5, 1955, and July 16, 1956 respectively. His last physical examination was taken on July 16, 1956. He had had 78-13 flight hours in the 30 days preceding the subject flight.

Navigator William B. Hoadley, age 32, was employed by Canadian Pacific Airlines on June 1, 1956. He held airline transport license No. 94, issued June 24, 1953. His total flight hours were 1,195. The date of his last physical examination was July 1, 1956.

Navigator William B. Scott, age 38, was employed by Canadian Pacific Airlines on June 4, 1956. He held airline transport license No. 113, issued July 13, 1956. He had had 170 flight hours with Canadian Pacific Airlines. His last physical examination was on June 5, 1956.

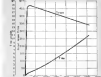
Second Officer John A. Baker, age 36, was employed by Canadian Pacific Airlines on Oct. 29, 1951, and began duty as second officer April 15, 1953.

Second Officer William, age 26, was employed by Canadian Pacific Airlines on Feb. 23, 1954. He had been on duty with the company from that time.

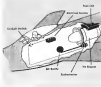
Stewardess Delores K. Joslin, age 21,



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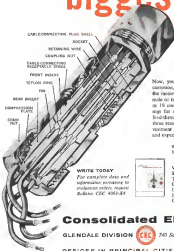


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LETTERS

Air-India Training

May we please refer you to the issue of *Airline World*, of Feb. 25, p. 29? Under the heading India, you have noted that we have international pilots and co-pilots "are still trained by Lockheed and KLM."

We would like to point out that your choice of word is incorrect, in that our pilots and co-pilots are not and have been trained by our own Training Operations section, initially by Lockheed personnel. It was a fact that when Air India International commenced operations in 1975, we had employed Chuck Poley from Lockheed to train our new recruits, but the system was discontinued in 1979 as soon as we were so advised that we had sufficient trained personnel to run our school. Similarly, we referred to KLM as the past as well as need some of our pilots for the Officer's training, as with our expanding operations we were unable to get all training within the short time available in our own establishment. Even this has caused some years ago, and, in fact also, we have at present a Training Operations under a Divisional Operations Manager assisted by a Flight Operations Manager and Chuck Poley—Air India, Bombay.

A. C. GANES
Technical Director
Air India International
Bombay Airport
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Bombay 29

Pilot's Viewpoint

More airline pilots, including myself, were deeply touched after reading your article on the case of TWA Capt Specht published some time ago (AW March 18, p. 30). Reading the partial excerpt you published gave the impression that Capt Specht asked for a special deal in regard to the accident and not well as he had the Civil Air Regulation No. 25, changing altitude without a clearance, but not himself.

Capt Specht's presence in court, his design, it appears from the published transcript that Capt Specht DID NOT decline an emergency EVROR in changing altitude while in an emergency actually existed.

As you are fully aware, the entire pilot of this country, in a group, are among the most well disciplined ones to be found anywhere. It does not seem reasonable to be lenient that an experienced TWA Captain of 15 years service would at his court of honor.

The CAA Administrator has suspended Capt Specht's license and until the case is settled Capt Specht is without license. If it is proved that Capt Specht did not act recklessly, and DID NOT decline a published emergency, before changing altitude, the CAA should "show the book" to him. The members of ALPA would be most unhappy if our industry were spent dealing in a new policy of the aforementioned rules.

Details: If each defendant the sponsor as evidence to the lower court in the emergency's external evidence. Address letters to the Editor, Airline World, 430 W. 40 St., New York 36, N.Y. We have letters under 500 words and give a personal identification. We will not send anonymous letters, but names of writers will be withheld on request.

If you without saying that with sufficient good responsibility, and the use of emergency authority used by with good reason—that there can be no intention on the part of me of that point.

It is my understanding that Capt Specht DID decline an emergency EVROR during the accident and that an emergency condition was the reason. If Capt Specht is cleared of the charges against him and acquitted, the only way he can remain his last moment is by the government's own account.

As I see it, a very fundamental point of law is here at stake. Under our legal system a man is presumed innocent until proven guilty, and yet in this case the man is suddenly presumed his hands out of his (my) hands and the "MAD of the CAA" guide him enough to determine his innocence or guilt.

Because you have a source of information from the airport pilot and because you're respected name as a writer, you will be doing all of us a service by going into this case in detail and publishing a complete report on it.

Leo Kestner
Captain
United Airlines
San Francisco, Calif.

More on Specht

I wish to look up Mr. David M. Tuck's criticism to Mr. Specht (AW May 25, p. 155). In spite of the discrepancy, or at least some something more than his report, I wish to see which report (May 6, p. 151).

At any rate, from about giving us the bookends in that incident, we have an Airline World and clear up the question mark.

Karl W. Frenkel
Amherst, Pa.

(Airline World will report the Specht case in detail as it is handled by the court system.—ED.)

Burning Issue

On p. 60 of the April 21 issue of *Airline World* ("Random Remarks Efficiency of Two"), is the interesting statement: "Lithium's electrolyte will not increase the battery efficiency of fuel by 10%."

Other facts would indicate the same are in progress. That is, statistically, we are seeing as one of the fact that lithium electrolyte of better than 90% can be achieved without electrolyte, even under such difficult conditions as rate more a jet engine. Possible applications are the imagination.

No need now to point out, as stated in places.

The place of the future need have not enough fuel tanks to hold the fuel needed by the engine till a jet aircraft is needed to land and to provide fuel; power. Lithium electrolyte could hold very large jet engine tanks to make jet fuel tanks could be converted to other types of fuel in existing airplanes with some modifications.

Sincerely, now, what's your like to tell us what you mean about "burning efficiency?"

Dr. J. K. Stevenson
Dr. John K. Stevenson
& E. Johnson
Ft. Worth, Tex.

(Airline World informed the letter to Prof. Stuart W. Churchill of the University of Michigan, whose reply follows.—ED.)

For the Record

This is in reply to your letter concerning the inquiry on the main item on printed on our web site on the Effect of Kerosene on Combustion (AW April 25, p. 80). The bibliography your article was incorrect and Messrs. Stevenson, Kestner, and Johnson were mentioned as well as three others in the letter. I appreciate that the name was misspelled, but could be very apparent if you would print a correction in as early issue.

The following are the facts:
We did observe an increase of 50% in the rate of pyrolysis of kerosene produced with a 0.001-gram gold source, and we also observed an increase in the rate of burning efficiency. Our work on kerosene burning efficiency about the rate of pyrolysis of kerosene. I have enclosed a copy of a manuscript which I prepared for the American Chemical Society News Service and also a copy of a letterhead to the University of Michigan News Service. The letter which was used as evidence and I did not have a chance to check it. Although the manuscript containing the performance of several engines as an indication on my actual results, the same science is obviously not.

You will note that both studies indicate a 50% increase in burning speed. The University of Michigan News Service also recognized my results in its letter. "Your own papers could be made more efficient. Although I would not have made this statement, it is completely possible in the name of maximum fuel burned per unit rate of input."

Thank you for calling attention to my work in Airline World. And thank you in advance for correcting the misquoting since that this time may be closed.

Stuart W. Churchill
Vanderbilt University
Department of Chemical and Metallurgical Engineering
Knox, Ariz., 861

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